THE AMERICAN
JOURNAL OF PHARMACY.

MAY, 1878.

FLUID EXTRACTS BY REPERCOLATION.

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As the time approaches for a revision of the U. S. Pharmacopœia those parts of it which require the most time and labor should be recognized, that due consideration may be given to them; and there is certainly no department of the work where more time and labor is needed than upon the Fluid Extracts and Extracts. Should the Committee of Final Revision fail to find and adopt the best plan of making this important class of preparations the Pharmacopœia instead of being the model and standard of the Nation will be surely disregarded and left behind by the practice and the results of the large manufacturer and the evil of the present will be confirmed and fastened upon the future.

It will not do for the Committee to disregard any plan because it is laborious, or troublesome, or expensive, or complicated, or because it is not adapted to the knowledge and capacity of the large majority of physicians and pharmacists. These, though very important, are still secondary considerations. The thing to be accomplished in the Pharmacopœia is to have practically perfect preparations in every respect. That is, preparations that are really what they profess to be. They should contain all the active and useful parts of the drug in their natural conditions and associations;—should reject as far as practicable the inert and useless portions of the drug; and should bear the established relation to the drug, of minim for grain;—or, weight for weight, if this can be accomplished without materially disturbing the established relation. To effect this object a general scheme, plan or process can be adopted, and then every drug must be studied carefully and laboriously.

The original process of Prof. Procter accomplished the exhaustion of the drug insufficiently, but that difficulty can be easily remedied by carrying the percolation farther. But the concentration of the weaker

percolate to obtain the established relation between the drug and the fluid extract presents difficulties which are probably insurmountable by that process. It is not simply by the heat and oxidation of the evaporation process that all the harm is done to that portion of the preparation, but the active principles are so dissociated and split up by the concentration that they are no longer in their natural condition, but form new relations and combinations which change their solubilities, and bring a new set of reactions into play, making the preparation something else than what it professes to be. The evidence of this is found in the fact that a resinous or oleaginous drug can be thoroughly exhausted by a menstruum which will permanently hold all its constituents in solution. But if such menstruum be evaporated off, the same menstruum will not dissolve and hold the extract again. Nor will any other menstruum ever again reconstruct the extract or restore it to its original condition. For example a diluted alcohol will exhaust Buchu and will hold the oil, while in its natural relations with other constituents of the leaf, in the same kind of combination or emulsion that exists in the leaf before extraction, and in such a solution, though very dense, the oil does not change in odor much,—if at all more rapidly than the leaf does. But if such a solution be evaporated until the oil is precipitated and shows itself as a fully formed oil, the same strength of alcohol will not redissolve it. Nor will any strength of alcohol redissolve the whole of the extract, or recombine its once separated elements into their natural condition. And moreover, the oil when separated, changes its physical properties more rapidly than when in its natural condition in the leaf, or than when separated with its natural associations unbroken. These circumstances constitute the chief objection to the original process, and to many of the original menstrua of Prof. Procter, and led the present writer to try to make improvements both in the process and the menstrua.

This effort at improvement by the writer was begun in a paper published in the Proceedings of The Amer. Pharm. Asso. for 1865, p. 201. To diminish the proportion of alcohol in the menstrua, and to economize its use, were the principal objects of this paper, and it is cited here for reference in regard to the importance of the points there insisted upon, because these points have not attracted the attention they deserve.

The effort at improvement was continued in 1866 by a paper pub-

lished in the Proceedings of that year, p. 81. In this paper the method by repercolation was first proposed and described as overcoming the principal objections to the previous methods.

This method of repercolation has now been exclusively used by the writer for nearly twelve years in the production of many thousands of pounds of all the principal fluid extracts, and the object of this paper is to sum up this experience, and publish the modifications of the process, as they have been suggested and successfully applied during this prolonged experience, with a view of bringing the process more prominently into notice in order to be critically examined and tested. The general results of the application of repercolation, in the writer's hands, are, that no other process yet proposed accomplishes the main objects so well; and therefore that unless some new process can be devised that may attain the objects better and more accurately than this, it should be the process adopted for the Pharmacopœia.

In 1867 papers by the writer upon this same subject, as applied to the Cinchonas, may be found in The Amer. Journ. of Pharm. for July, August and September, and in the Proceedings of The Amer. Pharm. Asso. for 1867, p. 391. All the principles involved in percolation and repercolation were fully discussed and illustrated in those several papers, but they seemed to attract little attention, and they are cited here to avoid recapitulation, since they cover nearly every point which the writer has now to bring forward. But the papers also contain many details which accumulating experience has improved and materially modified.

About 1870 a new form and arrangement of percolator was devised by the writer, and was put into practice so successfully that two years later in the Proceedings of The Amer. Pharm. Asso. for 1872, p. 182, an account of it, with a cut, were given in detail. This contrivance has now been in use continuously for about 8 years, upon every scale from 4 ounces to about 400 pounds, and by pretty thoroughly carrying out the principles involved in percolation, it has contributed very largely to the success and uniformity of the process in the writer's hands. But the apparent complication of this device, and the details of repercolation, seem to have operated against any general understanding of the process, so that it has probably been generally condemned without sufficient trial; while the physical laws which govern the relations between liquids and solids in the direction of discrimina-

tive solubilities have been still too much overlooked, in favor of the earlier and more simple processes.

Whatever may be said of the older processes in regard to simplicity and facility of application, by which they are adapted to any capacity, and thus go into general use, it may also be said with great certainty that under the ordinary conditions of their general use, they do not accomplish their object to a reasonable extent, or as well as other processes now known: and that although the resulting preparations are put forth in the Pharmacopœia as representing the drugs minim for grain, they do not really come near to this relation. The variations in the quality of the drugs used, and the variations in the moisture which they contain, are elements of so much uncertainty and want of uniformity in the liquid preparations made from them, that it becomes very important to reduce all other sources of variability to a minimum.

Repercolation, well applied, leaves little to be desired in making a liquid preparation that will fully represent the drug in almost any desired relation of strength; and if indifferently applied, the inaccuracies of one operation are so made up and controlled by those which follow that when the results of the different operations or percolations of the process are mixed together the general results must be practically good and uniform.

Indeed, so satisfactory has this process been in the writer's hands for the last 8 or 10 years, that the difficulties of making good fluid extracts have been entirely confined to the getting of good materials to make them from, and in controlling the hygrometric moisture in such materials when used. And in view of the satisfactory results, the inconveniences of the process and the disadvantage of having to carry a large stock of the weak percolate from each drug,—seem now to be of very much less consequence than at first.

Upon finding out how much more serious these inherent objections to repercolation appeared to others than to himself, and how little credit the process obtained for its results in the way of counterbalancing these objections, the writer set himself to the task of trying to simplify the apparatus and the process to the utmost extent that could be done without sacrificing the principles upon which the success depends: so that by doing away with the machinery and apparent complication of a special percolator, and as many details as possible, the process might appear less objectionable beside the older methods, and thus induce

pharmacists to learn it and try it long enough to become expert at it, and to be able to judge wisely in regard to its practicability and its appropriateness to pharmacopœial use.

These efforts at simplification are now to be set forth for whatever they may be worth, and they may be best introduced here by a model process.

For this model process it may be well here, again, to take the most difficult substance known to the fluid extract maker,—namely Cinchona bark. This was one of the substances investigated in the papers of 1867 above referred to, and they may be usefully read as including some points of investigation omitted here,—and especially in regard to testing the alkaloid value of different portions of the percolates.

The Cinchona used in the model processes to be given is of exceptionally good quality, and therefore exceptionally difficult to exhaust. It is a Yellow Cinchona from the C. officinalis cultivated in Java, and contains about 9 per cent. of total alkaloids of which about 7 per cent. is quinia. It is therefore more than three times the value of officinal Yellow Cinchona, and when such barks are used for making the fluid extract, this should be reduced to some standard of strength. That is, the Pharmacopœia should direct that its Fluid Extract should have a definite alkaloid strength. In these model processes however this Cinchona is used as if it was of the ordinary quality.

As the preparation of this paper for publication was undertaken by the special request of the Committee on the Pharmacopœia of The Amer. Pharm. Asso. for use in connection with their work of finding out the best way of making fluid extracts, the details of the processes must be given with a minuteness that may seem useless and tedious. Beside, it is a prominent object of the writer to show how, in his judgment, every individual fluid extract must be studied before is is adopted by the Pharmacopœia, if the utility and character of the Pharmacopœia as a standard for the nation is to be restored to it. Who is to do this work, and who is to pay for the time, skill and labor necessary to do it well, are problems for the future.

The first most important question is that of a proper menstruum. The present officinal menstruum having proved objectionable soon after the Pharmacopœia was issued, a menstruum was adopted by the writer containing 109 parts Alcohol, 16 parts water and 41 parts Glycerin. This menstruum has now been in successful use for many years and

affords good exhaustion, and a fluid extract which weighs 7685 grains to the pint. This is almost exactly minim for grain and weight for weight. But as the drug never is quite exhausted even under the very best management the measure never should have been made minim for grain if the drug was to be fairly and fully represented by the fluid extract. As a rule of actual practice, the drug will not often be exhausted within 5 or 10 per cent. and by the officinal management, will fall greatly below this. A more accurate proportion would have been 90 to 95 minims to each 100 grains of drug or about 8000 grains of drug to make a pint of fluid extract each minim of which should represent a grain of the drug. Even by repercolation some such excess is needed to make the therapeutic relation what it professes to be. Beside this objection of being too close in theoretical relation to be true in practical value, this menstruum has long been believed to be unnecessarily strong in alcohol, and containing too much glycerin. The glycerin in many cases has a secondary use in menstrua which is hardly less important than its primary use as a solvent. It has the property of wetting substances, and permeating them to the exclusion of air, to a much greater degree than water or alcohol, and, when mixed with water or alcohol imparts this property to the mixture. When used at all, therefore, it must be used with both these functions in view, and one step beyond this is objectionable. After a preliminary set of percolations with this old menstruum to observe how it would work on the small scale of 4 troy ounces of powder to each percolation, a new menstruum was tried consisting of 2 parts stronger alcohol, 2 parts water and 1 part glycerin, and a preliminary set of percolations upon the same scale of 4 troy ounces gave good results, but proved that the scale was so small as to need especial skill and care in order to attain the desired accuracy.

Another tentative trial was then made with this new menstruum on a scale of 8 avoirdupois ounces at each percolation, and this proved to be a much less troublesome scale. And, for Cinchona it is about as small a scale as can be worked to advantage. An avoirdupois pound would be better and easier still. The details of these trials need not be given, and it is sufficient to say that they indicated, and gave a part of the necessary experience needed for another careful trial, in which two very important points were still to be settled, namely the proportion of menstruum and weak percolate that was best to moisten the powder, and the length of time that was best to macerate each portion, the trials having

shown that great variation was produced by both these elements. It was at first believed that 4 parts of liquid was sufficient to moisten 8 parts of powder, and that 24 hours was long enough to macerate, and the first two percolations of the following series were made with these conditions. In the third percolation the liquid was increased to 5½ parts, and the maceration kept at 24 hours. In the fourth the liquid was increased to 6 parts. In the fifth it was kept at 6 parts, and the time of maceration was extended to 48 hours. In the sixth percolation it was increased to 7 parts, and the moistened powder, covered closely was allowed to stand 8 hours to absorb the liquid more thoroughly. Then the powder was passed through a No. 8 sieve, packed pretty firmly, filled with weak percolate and then macerated for 48 hours, making a total maceration of 56 hours.

The first percolation of the series, made with fresh menstruum throughout, is of course a simple percolation, and was carried to practical exhaustion. And this practical exhaustion was doubtless to within 5 or 10 per cent. of absolute exhaustion of all matters soluble in the menstruum. The residue was quite tasteless for more than half way down the percolator, and then began to be very slightly bitter. This bitterness increased until at the bottom of the percolator it was quite distinctly bitter, after percolation under very favorable circumstances with nearly four times its weight of menstruum.

It is quite certain that the extract obtained from a drug by percolation is not uniform throughout the percolation in its medicinal value. If the menstruum be well adjusted as a solvent of the active principles of the drug it will dissolve and carry out the most soluble portions first and in largest proportion, so that although doubtless some of the useful part continues to be present in all parts of the percolate and its extract, yet the proportion must diminish much more rapidly than the proportion of extract. This point is well shown, so far as Cinchona is concerned in a table given by the writer in the "Amer. Journ. of Pharmacy" for 1867 p. 402, where each portion of percolate and its extract were assayed for the total alkaloids they contained. Hence, though the quantity of dry extract yielded by different portions of the percolate be not a measure of the medicinal value of the percolate it is still the best guide that is easily accessible. Bearing in mind then, that medicinal exhaustion by percolation is more rapid than absolute exhaustion, and that the dry extract which measures absolute

exhaustion becomes poorer in medicinal efficacy and richer in inert extractive matter, and that this divergence in value is greatest near the end of the process, the quantity of dry extract yielded by each fraction of the percolate is adopted as the most convenient measure of the rate and the extent of the exhaustion.

The want of uniformity introduced into this series of percolations by the variation in the quantity of liquid used to moisten the several portions of the powder, and the variation in the time of maceration, diminishes the value of the series as illustrative of the best results of repercolation; and made it advisable to add a fifth and a sixth percolation to show the true character of the process when fairly established in actual practice; and thus these two percolations become by far the most valuable of the series as results of repercolation in actual practice, whilst the formula and process merely show how to begin to use repercolation.

The formula and process now to be given embrace the experience obtained in making the series which it represents, and is offered as a model by which other trials should be made by other hands, with other varieties of Cinchona.

Take of Yellow Cinchona, in powder No. 50,	. .	32 parts.
Stronger Alcohol,[1] s. g. ·819 at 15.6°C.=60°F., or s. g. ·811 at 25 °C.=77°F.,	2 parts.	For a sufficient quantity of menstruum.
Glycerin, s. g. 1·250 at 15·6°C.=60°F., or s. g. 1·244 at 25 °C.=77°F.,	1 part.	
Water, ...	2 parts.	

Weigh the Stronger Alcohol, Glycerin and water in succession, in any convenient quantity at a time, into a tared bottle, and mix them thoroughly for a menstruum.

Moisten 8 parts or the Cinchona with 8 parts of the menstruum, by thoroughly mixing them, and allow the mixture to stand 8 hours in a closely covered vessel. Then pass the moist powder through a No. 8 sieve, and pack it firmly in a percolator. Pour menstruum on top until the mass is filled with liquid and a stratum remains on top unabsorbed; cover the percolator closely and macerate for 48 hours. Then arrange

[1] It is hoped that in the next revision of the Pharmacœpia the "Alcohol" (s. g. ·835) may be dropped, and the simple name Alcohol be applied to a clean spirit, of about the s. g. here given.

the percolator for an automatic supply of menstruum, and start the percolation at such a rate as to give 1 part of percolate in about 4 hours. Reserve the first 6 parts of percolate and continue the percolation until the Cinchona is exhausted, separating the percolate received after the reserved portion into fractions of about 8 parts each.

Moisten a second portion of 8 parts of the Cinchona with 8 parts of the weak percolate,—the first portion that was obtained next after the reserved percolate,—and allow the moist powder to stand for 8 hours in a vessel closely covered. Then pack it moderately in a percolator, and supply the percolator automatically with the remaining fractions of the weak percolate in the order in which they were received, and finally with fresh menstruum until the Cinchona is exhausted. Percolate in the same manner and at the same rate as with the first portion of Cinchona, and reserving 8 parts of the first percolate, separate the weaker percolate into fractions of about 8 parts each.

Percolate the third and fourth portions of 8 parts each of the Cinchona in the same way as the second portion.

Finally mix the four reserved percolates together to make 30 parts of finished fluid extract; and having corked, labelled and numbered the bottles containing the fractions of weak percolate, set them away until the process for Cinchona is to be resumed

When this fluid extract is to be again made, repeat the process as with the second portion, and reserve 8 parts of the first percolate as finished fluid extract from each 8 parts of Cinchona from that time forward so long as the fractions of weak percolate are carried forward with which to commence each operation.

In applying this formula and process each part was taken as an avoirdupois ounce, and therefore each percolation was made with a half pound avoirdupois of the Cinchona; and the menstruum was made in a tared bottle from time to time as required.

As before stated, the series was made to consist of 6 percolations and therefore the last 2 are in addition to the 4 of the formula, as if the process had been twice resumed, and the results of these 2 are entitled to most attention as showing the true practical character of the process of repercolation. And every percolation which might follow these can be demonstrated mathematically to approach nearer and nearer to accurate results the farther the series is extended, since

every successive percolation tends to correct the errors and improve the accuracy of those which have preceded it.

For the purposes of this paper as a model, and to construct the following table, the percolate from the first five percolations of this series was divided into much smaller fractions than is directed in the process, or needed in actual practice, leaving for a subsequent table the model for actual practice. The fractions of the first 5 were somewhere near 2 parts or 2 ounces each,=56·7 grams. It was not easy to get them uniform in weight, and therefore this was not attempted. Each fraction was shaken up and accurately weighed. Then about 1 cubic centimetre was measured off into a tared shallow watch glass, and quickly weighed to avoid loss by evaporation. These weighed portions were then dried by steam heat until they ceased to lose weight and the residue carefully weighed. This gave the data for calculating the total residue which each fraction would give if the whole fraction had been evaporated. But a large proportion of this residue was glycerin, and it was sought to get at the extract only. So a cubic centimetre of the menstruum was weighed and evaporated in the same watch glass until it ceased to lose weight under the same conditions, and it was found that the residue weighed 16 per cent. of the weight of the menstruum. This was an unexpected result, for as the menstruum contained 20 per cent. of its weight of glycerin, it was to be expected that upon evaporation very nearly this proportion would remain on the watch glass. Therefore the trial was three times repeated, and the mean of the trials was within a very small fraction of 16 per cent., showing that about 4 per cent. of the glycerin went off with the alcohol and water. This gave the remaining element for closely approximating the extract in each fraction by the following formulas. As the weight of the cubic centimetre taken from each fraction of percolate is to the weight of the residue after evaporation, so is the weight of the entire fraction to the weight of the residue it would leave on evaporation. But had this fraction been menstruum instead of percolate, and been evaporated under the same conditions, it would have given 16 per cent. of its weight of glycerin as a residue. It was therefore assumed (though of course not correctly) that 16 per cent. of the entire fraction was glycerin. Then 16 per cent. of the weight of each fraction was taken and this amount

was subtracted from the calculated residue of the fraction, and the remainder was assumed as dry extract of cinchona. Next, as these fractions were not uniform in weight, the assumed extract did not represent a uniform proportion and rate of exhaustion. To show this rate of exhaustion better, a second proportion was made to represent it by per centage. As the total weight of the fraction is to the weight of extract obtained from it, so is 100 to the percentage of extract it contained. For example: The first fraction of the table weighed 62·72 grams. One cc. of this fraction weighed 1·062 grams. This, dried on a watch glass, gave a residue weighing ·488 gram. Then, As 1·062 : ·488 : : 62·72 : 28·82. But this 62·72 grams. is assumed to give 16 per cent. of its weight of glycerin which does not go off by evaporation or (As 100 : 16 : : 62·72 :) 10·04 grams. glycerin : and 28·82 residue less 10·04 glycerin leaves 18·78 as the approximate dry extract contained in the fraction of 62·72 grams. of percolate. Then if 62·72 percolate give 18·78 extract, 100 percolate would give 29·9 extract, equal the percentage of extract contained in the fraction of percolate.

The remaining column of the table gives the difference in specific gravity at similar temperatures, between the menstruum and the various fractions of the percolates, and this also illustrates the rate of exhaustion, but in a way much easier of application in practice than that of weighing the extract.

Repercolation of Cinchona: Menstruum—Stronger Alcohol 2, Water 2, Glycerin 1. S. G., ·9728 at 20°C.

Portions of Percolate of about 2 ozs.=56·7 grams. each.	First Percolation.				Second Percolation.				Third Percolation.				Fourth Percolation.				Fifth Percolation.				Sixth Percolation.			
	Grammes.				Grammes.				Grammes.				Grammes.				Grammes.				Grammes.			
	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.
1st Portion.....	62·72	18·78	29·9	·1312	60·51	17·09	28·2	·1160	62·41	20·23	32·4	·1468	62·41	19·50	31·2	·1484	51·06	17·76	34·8	·1640	.....	.....	.....	.....
2d "	59·85	16·09	26·9	·1112	55·76	17·99	32·3	·1292	56·24	14·07	25·0	·1180	58·61	15·46	26·4	·1300	63·06	22·57	35·8	·1684	.....	.....	.....	.....
3d "	57·63	13·54	23·5	·0960	60·48	18·53	30·6	·1244	59·20	10·93	18·5	·0908	57·63	11·25	19·5	·1000	63·68	19·82	31·1	·1536	.....	.....	.....	.....
4th "	58·62	11·97	20·4	·0836	58·57	12·70	21·7	·0912	62·49	13·06	20·9	·0984	48·15	8·68	18·0	·0900	51·55	14·16	27·5	·1324	228·32	63·85	28·0	·1560
5th "	78·30	14·59	18·6	·0708	57·68	6·69	11·6	·0612	56·30	8·74	15·5	·0716	60·52	10·42	17·0	·0824	64·46	14·50	22·5	·1080	.....	.....	.....	.....
6th "	57·88	6·83	11·8	·0388	56·84	5·97	10·5	·0494	56·51	7·10	12·6	·0548	58·17	8·18	14·1	·0696	61·12	16·47	26·9	·1344	134·52	28·77	21·4	·1244
7th "	50·74	4·80	9·5	·0220	51·82	5·46	10·5	·0512	59·92	6·85	11·4	·0564	52·28	6·77	12·9	·0612	54·74	10·03	18·3	·0944	.....	.....	.....	.....
8th "	64·06	4·71	7·4	·0132	51·45	2·96	5·8	·0328	59·53	5·62	9·4	·0440	55·70	6·97	12·5	·0596	61·09	8·71	14·3	·0748	114·19	18·38	16·1	·0812
9th "	70·27	5·50	7·8	·0092	50·89	2·39	4·7	·0276	68·68	7·39	10·8	·0368	54·24	5·99	11·0	·0516	58·79	7·27	12·4	·0636	.....	.....	.....	.....
10th "	65·00	1·35	2·1	·0072	47·08	4·29	9·1	·0416	60·33	5·36	8·9	·0344	61·91	6·81	11·0	·0494	59·54	5·87	9·9	·0532	120·30	21·79	18·1	·0808
11th "	57·97	·79	1·4	·0040	56·38	4·04	7·2	·0304	53·76	4·11	7·6	·0376	60·57	6·78	11·2	·0480	59·02	5·09	8·6	·0448	.....	.....	.....	.....
12th "	56·30	.....	.....	·0024	55·55	2·11	3·8	·0182	57·93	2·55	4·4	·0324	56·85	6·47	11·4	·0472	58·17	6·54	11·2	·0424	108·61	11·42	10·5	·0472
13th "	51·94	·79	1·5	·0024	52·48	1·51	2·9	·0156	92·00	2·72	3·0	·0252	61·17	7·02	11·4	·0428	53·22	5·41	10·1	·0400	.....	.....	.....	.....
14th "	.....	.....	.....	.....	56·60	1·78	3·1	·0176	61·34	2·72	4·4	·0236	62·35	5·88	9·4	·0394	63·48	6·46	10·2	·0356	122·68	12·53	10·2	·0420
15th "	.....	.....	.....	.....	56·43	1·22	2·2	·0148	58·42	2·18	3·7	·0200	58·67	3·78	6.4	·0376	63·34	5·44	8·6	·0324	.....	.....	.....	.....
16th "	.....	.....	.....	.....	53·50	1·10	2·0	·0168	53·45	1·76	3·3	·0230	56·17	4·14	7·4	·0360	58·32	4·35	7·5	·0284	117·56	5·51	4·7	·0260
17th "	.....	.....	.....	.....	57·90	2·25	3·9	·0168	48·75	1·46	3·0	·0244	60·12	3·04	5·1	·0332	58·32	4·49	7·6	·0264	.....	.....	.....	.....
18th "	.....	.....	.....	.....	55·24	2·67	4·8	·0156	65·36	3·34	5·1	·0304	64·82	3·59	5·5	·0280	65·39	3·75	5·7	·0212	119·79	3·43	2·9	·0200
19th "	.....	.....	.....	.....	68·22	2·78	4·1	·0152	66·56	2·32	3·5	·0156	53·92	1·88	3·5	·0240	59·91	3·46	5·8	·0188	.....	.....	.....	.....
20th "	.....	.....	.....	.....	86·88	2·49	2·9	·0092	65·24	1·91	2·9	·0116	55·06	1.14	2·1	·0208	60·20	4·17	6·9	·0180	122·59	·62	·5	·0196
21st "	.....	.....	.....	.....	.....	.....	.....	.....	51·99	·56	1·1	·0096	79·45	2·49	3·1	·0176	61·95	3·08	4·9	·0172	.....	.....	.....	.....
22d "	.....	.....	.....	.....	.....	.....	.....	.....	54·91	·91	1·7	·0072	63·58	·75	1·2	·0162	71·65	3·36	4·7	·0148	102·30	.....	.....	·0200
23d "	.....	.....	.....	.....	.....	.....	.....	.....	72·44	1·40	1·9	·0052	61·52	.....	.....	·0124	74·81	·45	·6	·0128	.....	.....	.....	.....
24th "	.....	.....	.....	.....	.....	.....	.....	.....	70·40	1·30	1·8	·0076	63·58	.....	.....	·0108	59·07	.....	.....	·0132	.....	.....	.....	.....
25th "	.....	.....	.....	.....	.....	.....	.....	.....	46·49	·54	1·2	·0046	57·27	·99	1·7	·0104	.....	.....	.....	.....	.....	.....	.....	.....
Total.....	791·28	99·74	.....	.....	1150·26	116·02	.....	.....	1520·65	129·13	.....	.....	1484·72	147·98	.....	.....	1455·54	193·15	.....	.....	1290·86	166·30	.....	.....
Reserved Extract..	.....	48·41	.....	.....	.....	66·31	.....	.....	.....	58·29	.....	.....	.....	54·89	.....	.....	.....	74·31	.....	.....	.....	63·85	.....	.....
Extract carried forward.....	.....	51·33	.....	.....	.....	49·71	.....	.....	.....	70·84	.....	.....	.....	93·09	.....	.....	.....	118·84	.....	.....	.....	102·45	.....	.....
Actual Extract obtained.....	.....	99·74	.....	.....	.....	64·69	.....	.....	.....	79·42	.....	.....	.....	77·14	.....	.....	.....	100·06	.....	.....	.....	47·46	.....	.....

In interpreting the results of this table the disturbing effect of the trials of different degrees of moistening and different length of maceration, must be borne in mind as largely concerned in the discordant results. But this discordance fairly shows first the necessity for careful investigations and trials, since otherwise the discords would have escaped observation; and next shows the certainty with which each operation tends to control and correct the results of the preceding one until uniformity be reached. The residue of each percolation was critically examined by tasting, and in none was the exhaustion absolute. As the percolators were emptied the upper eighth would be tasteless as a rule; then the bitter taste would be perceptible and would gradually increase to the bottom. At three-fourths down it would be very decided, and the remaining fourth would be pretty strongly bitter. The different percolations were only moderately uniform among themselves, and the want of uniformity was mainly in the lower third of the residue. But the residues were much more uniform among themselves than were the proportion of extract obtained, and all were fairly exhausted. The first and sixth percolations gave the most thoroughly exhausted residues, and yet the extract obtained, as shown by the table, was about two to one. This shows in a striking way that the extractive matter is not a measure of the exhaustion as judged by the bitterness of the residue. Therefore in using the quantity of extract as a guide to exhaustion, if the quality of the extract be not ascertained the condition of the residue must be used as a check upon the extract as a guide.

The general result however, as shown by even a glance at the table, —a result that could be obtained in no other way,—though favorable to repercolation, is unexpectedly unfavorable to the menstruum used because of the overloading and masking effect of the excess of soluble extractive matter in this exceptionally rich, soft, soluble bark. Therefore another percolation,—the seventh of this series,—was made with another grade of Cinchona using the same weak percolates and menstruum. This Cinchona was the poorest in the writer's possession. It is from the C. officinalis cultivated in Ceylon, and contains between 4 and 5 per cent. of total alkaloids, of which about three-fourths is quinia. Therefore though still much richer than the U. S. P. Yellow Cinchona it is much nearer to it than the Java Cinchona is. This 8 ounces =226·7 grams. of the new powder was as well exhausted as the other percolations with 1136·33 grams. of percolate in 5 portions of

about 8 ounces =226·8 grams. each. These portions, by the same calculations, yielded respectively 59·85, 37·26, 22·16, 7·15 and 2·77 grams, =129·19 grams. of extract. Of this 102·45 grams. was carried forward to it in weak percolates from the sixth percolation of the table. The 8 ounces =226·8 grams. reserved contained 59·85 grams. of extract, leaving 4 portions of weak percolate to be carried forward containing (129·19—59·85 =) 69·34 grams. of extract. But the extract which appears to have been obtained by this percolation is only (129·19 —102·45=) 26·74 grams. and yet the powder was about as well exhausted as any of the previous percolations, and the weak percolates carried forward were much less loaded with extractive.

This improvement of the process by the use of a less exceptional quality of Cinchona was however still evidently insufficient, and left it still short of the best results. The menstruum was next to be changed, as it plainly needed more alcohol to exclude some of the extract, and probably less glycerin.

A new menstruum was made consistiug of 5 parts stronger alcohol, 4 parts water and 1 part glycerin. The s. g. of this mixture was ·9575 at 15·6° C.=60° F., or ·9496 at 25° C.=77° F. A cubic centimetre of this menstruum carefully weighed and evaporated on a watch-glass left 7·75 per cent. of glycerin not evaporable at the temperature to which the fractions of percolate were submitted. A new series of percolations was started with this menstruum, and was conducted precisely as with the former series. The first two percolations were made with the rich Java Cinchona so as to compare the results of the two menstrua upon the same powder; and then a third percolation was made with the Ceylon powder for comparison with the other menstruum upon this powder as above given in the seventh percolation of the former series. There was not time to extend this series beyond the third percolation, but fortunately the indications from the three are pretty clear. In this series the percolate was divided into portions of 8 ounces =226·8 grams. each except the first portion of the first percolation, which was 6 ounces =170·1 grams. and the powder in each was moistened with 8 ounces =226·7 grams. of menstruum or weak percolate. So moistened it could not have been passed through the sieve at once, but by standing for the prescribed 8 hours in a closely-covered vessel the liquid was absorbed by the powder, and then it was easily passed through the sieve. When moistened to this extent the powder must not

be firmly packed, and it is quite important to use the largest practicable quantity of liquid to moisten the powder in repercolation. The results of these percolations are given in the following table.

Repercolation of Cinchona,—Menstruum 5, 4 *and* 1, *s. g.* ·954 *at* 20° *C.*

Portions of Percolate of about 8 ounces=226·7 grams. each.	JAVA CINCHONA.								CEYLON CINCHONA.			
	First Percolation.				Second Percolation.				Third Percolation.			
	Grammes.				Grammes.				Grammes.			
	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.	Weight of Portions of Percolate.	Weight of Dry Extract.	Percentage of Dry Extract.	Difference in Specific Gravity.
1st portion.....	170·20	48·44	28·4	·1264	226·93	74·77	32·9	·1384	226 84	58·18	25 7	·1048
2d "	226 80	31 42	13·9	·0672	227 00	45·31	20·0	·0880	227 11	28·00	12·3	·0480
3d "	226·75	8 02	3·1	·0102	226·85	5·95	2·7	·0180	226 80	17 94	7·9	·0340
4th "	206·17	2 96	1·4	.0052	226 78	3 88	1·8	·0092	227·00	15·35	6 8	·0268
5th "	114·61	·37	·3	·0060	226 83	2 60	1·1	·0124	226·91	8·84	3·9	·0192
									226 70	2·33	1·0	·0140
									226·82	1·29	·5	·0090
Total.....	944·53	91·21	.....	.....	1134·39	132·51	.....	.....	1588·18	131·93	.....	.....
Reserved Ext....	.....	48·44	.....	.....	.....	74·77	.....	.....	.....	58·18	.....	.....
Extract carried forward,.....	.....	42·77	.....	.....	.....	57 74	.....	.....	.....	73·75	.....	.....
Actual extract obtained.....	.....	91·21	.....	.....	.....	89·74	.....	.....	.....	74·19	.....	.....

It remains now to give a summary of the results obtained from these two series, as bearing upon the relation between the weight and measure of the reserved portion of each percolation.

FIRST SERIES OF PERCOLATIONS.			
Reserved Portions.	Weight. Grammes.	Measure. Cubic Cent.	Difference Per cent.
1st Percolation..	171·10	156	7·6
2d "	226 80	214	6 0
3d "	226·80	210	7 5
4th "	226 80	208	8·3
5th "	226·80	204	10·1
6th "	226·80	201	11 4
7th "	226·80	206	9 2

SECOND SERIES OF PERCOLATIONS.			
Reserved Portions.	Weight. Grammes.	Measure. Cubic Cent.	Difference Per cent.
1st Percolation.....	170·20	158	7·1
2d "	226·90	210	7 5
3d "	226 80	216	5·0
4th "	226·80	208	8·3
5th "	226 80	.....	.....

The deductions which the writer draws from the work here given as applicable to the present pharmacopœial practice, and that which may be desired for the future are mainly as follows:

First, that the present formulas and processes for percolation are so defective that the relation to the drug which they profess is not practically accurate either as to quality or quantity, and therefore that a better process is greatly needed.

Second, that the process by repercolation, though it has some grave disadvantages, and is liable to defects in practice,—yet gives far better results both in quality and quantity of product; while it is not difficult in practice except by comparison with the delusive simplicity of the former processes; and therefore that repercolation is better adapted to pharmacopœial use as a model or standard process than any which has yet been tried.

Third, that repercolation may be used on a scale as small as 4 or 8 ounces, by great care and skill, but is not very successful with less than an avoirdupois pound of material for each percolation.

Fourth, that powders for percolation should not be finer than No. 60 for hard compact substances, nor coarser than No. 40 for more loose and spongy substances,—with a few special exceptions.

Fifth, that the menstruum should be so adjusted as to dissolve out the medicinal principles with the least practicable disturbance of their natural relations to each other and to the extractive matters whereby they are rendered soluble and permanent. Next that the menstruum should contain the smallest practicable proportion of alcohol; and glycerin only when absolutely necessary, as in Cinchonas. And finally that the menstruum should be so adjusted that when the fluid extract represents the drug weight for weight it should also represent the drug by not less than 90 minims to the 100 grains, or more than 97 minims to the 100 grains, since by repercolation the exhaustion is never less than 90 per cent. and perhaps rarely more than 97 per cent. of the total soluble matter.

Sixth, that the powder be moistened with as much liquid as it can be made to hold and yet pass through a No. 8 sieve; that it be not tightly packed; and that it be well macerated before starting the percolation.

Seventh, that the rate of percolation be uniform and very slow. At first, for the reserved portion, the percolate in 24 hours should

not exceed the weight of the powder; nor need the rate be slower than to obtain the weight of the powder in 48 hours, although as a general rule the slower the rate the better the results. After the reserved portion the rate may be increased gradually so that the last portion be received in about 6 hours. The separate portions of weak percolate should not exceed the weight of the powder.

Eighth, that a good practical exhaustion requires,—as a general rule,—for the first percolation, with fresh menstruum, that the total percolates should weigh 3·5 times the weight of the powder. That for the second percolation or first repercolation, the weight should be 4·5 times that of the powder. And for all subsequent repercolations the weight should be 5, 6 or 7 times that of the powder, according to the nature of the substance percolated, and the skill and care with which the process is managed.

Ninth, that the relation of weight for weight, instead of minim for grain, should be established under proper controlling conditions. But that unless properly guarded in the quality and moisture of the drug used, the new relation is liable to be even more inaccuate than the old, because, the poorer the quality of the drug the less dense will be the percolates, and the greater will be the volume for the prescribed weight, and this involves the serious difficulty that when the fluid extract is made by weight but administered by measure, the poorer the drug from which it was made the smaller, as well as the weaker, the dose will be.

Tenth, that some good practical method of comparing fluid extracts by a standard is very much needed; and that for such drugs as Cinchona, a method of arithmetical dilution would be easy and practical if well worked out.

Whilst the above-mentioned work on Cinchona was in progress a paper by Mr. J. U. Lloyd of Cincinnati appeared in the "Am. Jour. Phar." for 1878, p. 1, upon Fluid Extract of Cimicifuga. This paper contains so many valuable observations made without bias, and with such care and labor as at once to command attention. The results however were in many important respects so at variance with those of the previous experience of this writer as to force upon him the conclusion that Mr. Lloyd might have misinterpreted some of his observations; and if so it was important that his work should be gone over in the light of the many useful suggestions it contains for those who

might follow him. It is regretted that he did not refer to later papers on the subject of percolation and repercolation,—or at least did not adopt some important modifications that are published in later papers.

His work upon Cimicifuga has been repeated by precisely the same method as given above for Cinchona,—that is in accordance with the later experience on percolation and repercolation,—and the results are given. Those who will compare these results with those of Mr. Lloyd will find important discrepancies which must belong to one set of observations or the other. On one important point Mr. Lloyd must reach a wrong conclusion, for it certainly can be demonstrated upon well known physical laws, that maceration to a proper extent is useful and necessary to other conditions of the problem. This point is so well established by general experience that this part of his work was not gone over. The formula and process adopted here were as follows:

Take of Cimicifuga, in powder No. 60, . . 32 parts.
Stronger Alcohol, s. g. ·819 at 15·6°C=60°F,
or s. g. ·811 at 25°C.=77°F., a sufficient quantity.

Moisten 8 parts of the Cimicifuga with 2 parts of the Alcohol, and pack it firmly in a percolator. Then pour Alcohol on top until the moist powder is thoroughly filled with liquid and the air is forced out, cover the percolator and macerate for 48 hours. Then arrange the percolator for an automatic supply of menstruum, and start the percolation at such a rate as to give about one part of percolate every three hours. Reserve the first 6 parts of percolate, and continue the percolation to practical exhaustion, receiving the weaker percolate on separate portions of about 4 parts each.

Then moisten a second portion of 8 parts of the Cimicifuga with 2 parts of the second percolate from the first portion of powder, pack it firmly in a percolator, and supply it on top, first with the remaining 2 parts of the second percolate from the first portion, and then with the successive weak percolates in the order in which they were obtained, until the moist powder is entirely filled with liquid. Then macerate for 48 hours, and percolate to practical exhaustion at the same rate as in the first portion of the Cimicifuga, using first the weak percolates in their proper order, and then fresh menstruum. Reserve the first 8 parts of percolate, and receive the weak percolate in separate portions of about 4 parts each.

Then moisten a third portion of 8 parts of the Cimicifuga with 2 parts of the second percolate from the second portion of the Cimicifuga, and conduct the percolation in exactly the same manner as in the second portion, reserving the first 8 parts of percolate.

Then moisten the remaining 8 parts of the Cimicifuga for a fourth percolation, and conduct it in exactly the same manner as the second and third portions.

Mix the four reserved percolates, weighing 30 parts, and set it by as finished Fluid Fxtract of Cimicifuga: and having properly labelled and numbered the separate portions of weak percolate, set these by until the process for making this preparation is to be resumed, and then use them exactly as in the second, third and fourth percolations, reserving 8 parts of the first percolate from each 8 parts of powder as the finished fluid extract, ever after, and setting aside the weak percolates from each operation to be used in the next succeeding one.

In applying this formula and process each part was represented by a troyounce, and therefore the percolations were made with 8 troyounces of powder each. For the purposes of this trial the percolate was separated in portions of about 2 troyounces or 62 grams. each instead of 4 troyounces as indicated in the process, and each separate portion was carefully weighed. A cubic centimetre of each portion of percolate was carefully weighed on a flat watch-glass, and then dried and the dry extract weighed. Then a proportion was made by calculation from these data to find the total dry extract in each portion of the percolate, this proportion being as follows: As the weight of the cc. of percolate is to the weight of dry extract which it yielded, so is the whole portion of the percolate to the dry extract it contains. Having thus obtained the total dry extract contained in each portion of percolate, the sum of these would be the total extract of all the portions. But as these portions varied in weight the series would not represent the rate of exhaustion. Therefore another proportion was made to show the rate or progress of exhaustion by the percentage of dry extract contained in each portion of percolate. The formula for this proportion is as follows: As the weight of the portion of percolate is to the weight of extract which it contains, so is 100 to the percentage of the dry extract contained in the portion of percolate. The difference of specific gravity between the menstruum and the percolate, which also shows the rate of exhaustion was obtained by a small s. g. flask.

The following table gives the detail of these observations in compact form, but, as it was found by examination of the residue that the strong alcohol did not fully exhaust the Cimicifuga, the percolations were only carried as far as the third, at which point it was determined to try a new menstruum, in another process.

Cimicifuga, with Stronger Alcohol.

Portions of Percolate.	First Percolation.				Second Percolation.				Third Percolation.			
	Grammes.				Grammes.				Grammes.			
	Weight of Portion of Percolate.	Weight of Dry Extract.	Per cent. of Dry Extract.	Difference of S. G.	Weight of Portion of Percolate.	Weight of Dry Extract.	Per cent. of Dry Extract.	Difference of S. G.	Weight of Portion of Percolate.	Weight of Dry Extract.	Per cent. of Dry Extract.	Difference of S. G.
1st	69·20	7·78	12·51	·0444	63·41	12·15	19·16	·0636	61·22	10·98	17·93	·0556
2d	65·35	6·25	9·56	·0330	64·23	8·08	12·58	·0440	66·35	8·53	12·86	·0476
3d	64·51	4·84	7·50	·0264	63·12	6·82	10.80	·0328	64·30	6·97	10·84	·0372
4th	63·03	3·36	5·33	·0232	62·54	4·22	6·74	·0240	55·00	4·79	8·71	·0352
5th	61·22	2·30	3·76	·0184	61 65	3·54	5·74	·0204	62·00	4·32	6·97	·0272
6th	60 24	1·69	2·80	0140	62·36	2 90	4·65	·0164	62·22	3·38	5·43	·0224
7th	61·00	1 30	2·13	·0116	63·11	2·63	4·17	·0128	63·34	2·76	4·36	·0184
8th	60 02	1·29	2·15	·0108	63·41	2·21	3·49	·0104	62·24	2·51	4·03	·0148
9th	65 37	1·11	1·70	·0096	62·12	1·76	2·83	·0068	62·56	2·18	3·48	·0124
10th	61·86	1·11	1·79	·0028	62·32	1·53	2·46	·0044	63·06	1 98	3·12	·0096
11th	112·52	·91	·81	·0036	62·24	1·39	2·23	·0060	64 02	1·80	2·81	·0100
12th	108·01	1·25	1·16	·0016	63 33	1 16	1·83	·0044	63·44	1·68	2·65	·0100
13th	.....	.....	.....	.....	80·01	1·77	2·21	·0060	62·32	1·20	1·92	·0082
14th	.....	.....	.....	.....	98·00	1·90	1 94	·0052	66 80	·90	1·35	·0018
Totals	845·33	33·19	.....	.....	931·85	52·06	.....	.....	878·87	53·98	.....	.....
Reserved Extract	.....	18·87	.....	.....	.....	31·27	.....	.....	.....	31·27	.....	.....
Extract carried forward	.....	14·32	.....	.....	.....	20·79	.....	.....	.....	22·71	.....	.....
Extract from each Percolation	.....	33·19	.....	.....	.....	37·74	.....	.....	.....	33·19	.....	.....

The first percolation of the table being simply a percolation with fresh menstruum to practical exhaustion, serves to compare and check the other percolations in their results. The 8 troyounces of Cimicifuga =248·8 grams. required 845·33 grams. of percolate for practical exhaustion, though this was short of actual exhaustion. The total percolate is therefore nearly three and a half times the weight of the powder, and is as little as will give a practical exhaustion of this drug with this menstruum. This is more than double the proportion of the officinal U. S. P. formula, and accounts for a part of the defects of the officinal preparation. The extract obtained for this first percolation

of the table is 33·19 grams. or (248·8 : 33·19 : : 100 :) 13·34 per cent. of the weight of the powder. Then as these percolations were made by repercolation, the total extract should be (33·19 × 3 =) 99·57 grams. But the total obtained (33·19 + 37·74 + 33·19 =) 104·12 grams. slightly exceeds this, showing that the total exhaustion was rather better than the first of the series.

Now if the total extract to be expected from the 24 troy-ounces = 746·4 grams. of powder be 99·57 grams., and as the finished fluid extract is to weigh only (6 + 8 + 8 =) 22 troyounces = 684·2 grams., then the extract which should be contained in the reserved portions which constitute the finished fluid extract should be (As 746·4 : 99·57 : : 684·2 :) 91·27. But really the total extract in these reserves is only 18·87 + 31·27 + 31·27 =) 81·41 grams. or 10·16 grams. less than it should be. This deficit is mainly due to the process having been stopped at the third percolation instead of being carried on to include the fourth. In order that the fluid extract should represent the drug grain for grain, or weight for weight, if the extract was all of equal medicinal value, the reserved percolates should weigh 186· + 248·8 + 248·8 grams., and should contain 24·9 + 33·19 + 33·19 grams. This fluid extract, to have represented the drug in the relation of minim for grain should have measured (177·12 + 236·16 + 236·16 =) 649·44 cc., but it really measured 676 cc., and therefore the minim did not represent the grain ($\frac{649}{676}$) though the preparation is much stronger than the officinal one which purports to have this relation.

To endeavor to remedy the apparent defects of this process and make a preparation which shall more nearly represent the entire drug, another set of repercolations was made with a new menstruum. As the officinal menstruum, namely stronger alcohol, did not fully exhaust the drug, and separated out the resinous portions from their natural associates and solvents in the drug, the attempt was made to go to the other extreme and try a solvent or menstruum which should contain perhaps too little alcohol, and if so, yield a preparation overloaded with extractive matter, so that by comparing the results of the extremes, a better menstruum than either extreme might be found. With this object the new menstruum was made of equal parts (by weight) of stronger alcohol s. g. ·819 at 15·6° C. = 60° F., or ·811 at 25° C. = 77° F. andwater. This mixture required 26·5f℥ of water to 2 pints of

stronger alcohol. The s. g. of this mixture is ·926 at 15·6°C.= 60°F. or ·919 at 25°C.=77°F. or ·9236 at the room temperature at which the weighings were made.

The same formula and process were used as in the first repercolations of Cimicifuga, with the exception of the menstruum, and the powder was from the same stock, and used on the same scale of a troyounce=31·1 grams. for each part, and therefore 8 troyounces= 248·8 grams. of powder for each percolation; and in this case the whole four percolations were made. The following table gives the results of this repercolation, and contains the same elements obtained in the same way, but the first percolation attained a much more thorough exhaustion, while the subsequent ones were not carried so far on account of the apparent inertness of the extractive matter obtained. The third percolation was much less successful than the others in consequence of too short a maceration. This carried too much of the extract forward by the weak percolates into the fourth percolation, and overloaded it. But this serves as an excellent example of the way in which the errors of one percolation are corrected by those which follow when repercolation is used.

Cimicifuga with New Menstruum.

Portions of Percolate.	FIRST PERCOLATION.				SECOND PERCOLATION.				THIRD PERCOLATION.				FOURTH PERCOLATION.			
	Grammes.			Difference of S. G.	Grammes.			Difference of S. G.	Grammes.			Difference of S. G.	Grammes.			Difference of S. G.
	Weight of Percolate.	Weight of Dry Extract.	Per cent of Dry Extract.		Weight of Percolate.	Weight of Dry Extract.	Per cent. of Dry Extract.		Weight of Percolate.	Weight of Dry Extract.	Per cent of Dry Extract.		Weight of Percolations of Percolate.	Weight of Dry Extract.	Per cent. of Dry Extract.	
1st	69·18	23·55	34·04	·1212	67·78	22·56	33·29	·1104	64·67	16·89	26·12	·0948	67·55	24·53	36·31	·1324
2d	70·72	19·45	27·50	·0944	64·59	15·65	24·23	·0824	64·22	14·58	22·70	·0808	65·07	21·10	32·58	·1148
3d	66·88	13·27	19·70	·0716	65·07	15·14	23·27	·0800	66·17	13·13	19·84	·0728	57·92	15·28	26·38	·0928
4th	64·34	9·72	15·10	·0548	64·08	14·08	20·36	·0700	66·67	11·62	16·00	·0630	38·70	13·06	22·25	·0820
5th	64·55	7·12	11·03	·0408	76·12	12·26	16·11	·0556	65·90	9·85	14·95	·0536	53·34	7·22	13·54	·0684
6th	62·34	4·48	7·18	·0312	63·73	7·92	12·43	·0452	60·43	7·45	12·33	·0432	60·49	9·25	15·29	·0560
7th	62·31	3·19	5·12	·0248	65·14	6·25	9·58	·0372	90·10	8·63	9·05	·0344	65·63	8·24	12·55	·0480
8th	83·27	2·52	3·03	·0160	64·50	5·98	9·27	·0348	56·89	4·40	7·73	·0284	58·34	6·84	11·72	·0452
9th	107·89	·93	·86	·0080	88·97	5·21	5·85	·0244	69·75	5·25	7·53	·0268	66·83	7·36	11·01	·0436
10th	56·52	·46	·81	·0072	65·03	2·35	3·61	·0176	53·83	3·64	6·77	·0248	65·17	6·03	9·25	·0384
11th	65·64	·18	·27	·0096	64·43	1·70	2·64	·0138	62·49	3·36	5·38	·0176	59·91	6·05	10·09	·0364
12th	63·91	·03	.....	·0044	64·43	1·49	2·31	·0118	63·66	4·17	6·55	·0216	63·99	5·21	8·14	·0332
13th	121·02	·06	.....	·0056	63·94	1·54	2·41	·0086	54·35	2·67	4·91	·0168	63·68	4·31	7·08	·0250
14th	.....	.....	.....	.....	63·94	1·10	1·72	·0066	112·57	5·88	5·22	·0196	61·60	3·43	5·57	·0196
15th	.....	.....	.....	.....	63·80	1·01	1·51	·0038	63·57	3·00	4·72	·0172	59·70	2·97	4·98	·0204
16th	.....	.....	.....	.....	39·59	·68	1·70	·0026	63·57	1·99	3·13	·0172	67·13	2·19	3·26	·0132
17th	.....	.....	.....	.....	.....	.....	.....	.....	89·44	2·90	3·25	·0156	63·10	1·05	1·66	·0108
18th	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	61·86	·59	1·60	·0064
19th	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	100·86	1·14	1·13	·0032
20th	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	67·11	·58	·86	·0040
Total	958·57	.....	.....	.....	1050·22	.....	.....	.....	1167·98	.....	.....	.....	1287·98	147·03	.....	.....
Reserved Ext.	.....	84·96	.....	.....	.....	114·92	.....	.....	.....	119·41	.....	.....	.....	147·03	.....	.....
		56·27	.....	.....	.....	67·43	.....	.....	.....	56·22	.....	.....	.....	73·97	.....	.....
Extract carried forward	.....	28·69	.....	.....	.....	47·49	.....	.....	.....	63·19	.....	.....	.....	73·06	.....	.....
Ext. from each Percolation	.....	84·96	.....	.....	.....	86.23	.....	.....	.....	71·98	.....	.....	.....	73·84	.....	.....

The first percolation of 8 troyounces=248·8 grams. required a total percolate of 958·57 grams. for exhaustion, or nearly four times the weight of the powder, and gave 84·96 grams. of extract, which is

34·14 per cent. of the weight of the powder. The 32 troyounces= 995·33 grams. of powder should therefore give (84·96×4=) 339·84 grams. of extract. But when the extract actually obtained from the four percolations is summed up, it is found to be only (84·96+86·23+ 71·92+73·84=)316·95 grams. or 22·89 grams. less than the indicated quantity. This is therefore an apparent loss of (As 995·33 : 316·95 : : 100 : 31·84, and 34·14—31·84=) 2·3 per cent., which considering the apparent quality of final extracts in repercolation, is quite unimportant, at least in view of the far greater deficiencies of the officinal processes, or any modification of them hitherto used.

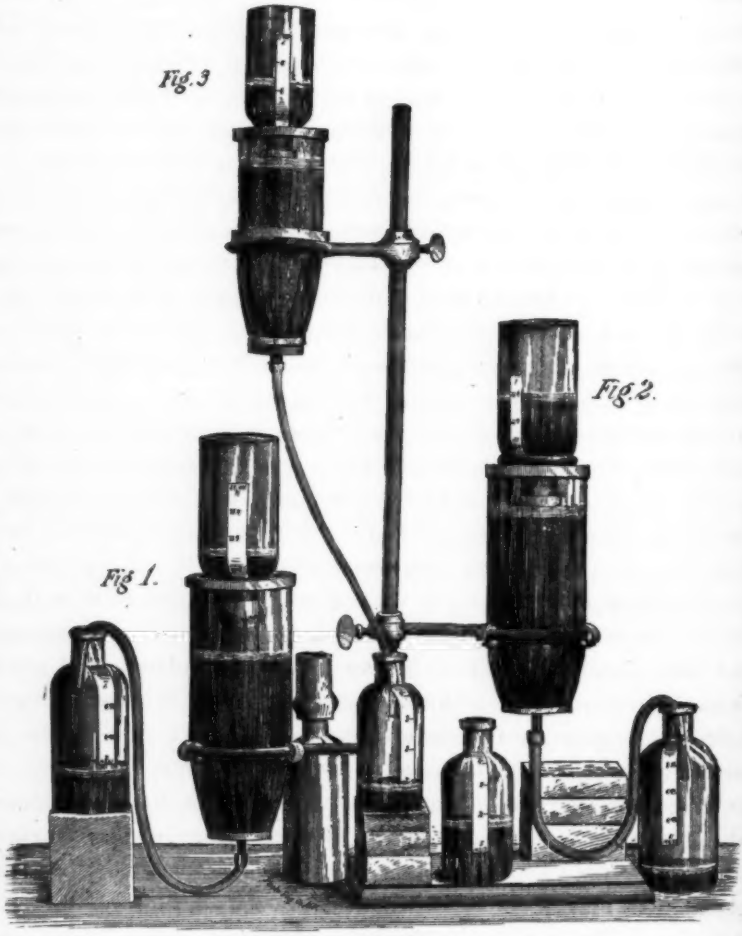
Now if each troyounce of powder is to be represented by a troyounce of the fluid extract, and the fluid extract be adjusted to the solid extract obtained, then the reserved percolates should weigh, respectively, 186·6, 248·8, 248·8, and 248·8 grams. and should contain 59·41, 79·22, 79·22, and 79·22 grams. of extract. But by the table the reserves weigh 206·78, 266·60, 261·73 and 249·24, and contain 56·27, 67·43, 56·22 and 73·97, thus making a very imperfect exhibit though still far ahead of the present or past officinal processes. The conditions being new each percolation was varied in management in order to reach the best method, it was not reached until the fourth percolation, and one or two more percolations, using much more liquid to moisten the powder, would have been needed to obtain greater precision and uniformity. The total finished fluid extract which should represent 30 troyounces=933 grams. of the drug, when made to bear the relation of minim for grain weighed 984 grams. and was therefore considerably too heavy. This, and the tendency of the percolate to become overloaded with extractive, at the same time that it illustrates the value and appropriateness of the principle of repercolation, also shows that this new menstruum has too little alcohol, and leads to the inference that a menstruum of 2 parts stronger alcohol and 1 part water would be better adapted to Cimicifuga than either of the extremes here tried. Such a proportion would, by repercolation, probably yield a fluid extract which in the proportion of weight for weight, would also have the proportion of minim for grain,—or what would represent the drug better because more accurately than by any known method of percolation,—including repercolation,—namely 90 to 95 minims for each 100 grains of the drug. In readjusting all fluid extracts therefore to bear the relation of weight for weight to the drug,

the weight should measure in minims from 90 to 95 minims for every 100 grains to make the therapeutic value of the minim and grain, of the fluid extract and the drug practically equal. This can be readily done by variations in the menstrua used, but not without the expenditure of much time, skill and labor,—an amount which no individual or committee can afford to give, but which a Pharmacopœia must have, in order to be respected as a standard. It may be mentioned in illustration of this point that all the time and labor that the writer could possibly spare, including at least three evenings of every week, for three and a half months, has been given to this paper which embraces only two fluid extracts, neither of which are yet in the condition they should be for the Pharmacopœia for want of more time and labor.

It now remains to give some account of the mechanical contrivances which, in the hands of the writer, seem best adapted to a uniform and practically good exhaustion of the soluble portions of drugs without the use of heat, so that the fluid extract of the drug shall bear a tolerably definite and uniform relation to the drug of minim for grain and weight for weight, for the writer now believes that both these relations can be had at once with a practical and sufficient degree of accuracy, —or with accuracy enough for the present relations of pharmacy to therapeutics. It can hardly be doubted that by a competent knowledge of known physical laws, and by a fair application of this knowledge to the problem, a fluid extract can be made by repercolation, without heat, bearing the proper relation, with great accuracy, but the success or want of success with which this is done will vary much more with the degree of knowledge and skill applied to it, than with any particular form of apparatus used. That is, the measure of success will always be in the application of well-known physical laws. The writer therefore desires to guard against any misleading effect of a simplicity that is not intended to be *ad captandum*, for it would be very hurtful to continue in the present to underrate a problem which has been so very much underrated in the past. If the principles involved, and the difficulties of carrying them out, be once fairly comprehended, the mechanical appliances may be easily varied, and yet must still leave some one contrivance as the best until a better be found.

No better form of apparatus has been found by the writer than that which has now been used, upon various scales, during the past twelve years, an account of which was published in 1872, and which is repro-

duced with improvement and amplification at the end of this paper. To simplify this apparatus with the slightest possible sacrifice of the principles involved, with the object of getting the principles to be better and more generally understood and applied where so much needed, is the object of introducing the modified apparatus shown in the following cut.



Scale, one-sixth of the actual linear size.

The cut presents three separate groups of apparatus in positions to illustrate three stages of repercolation, and it is to be understood that

all intermediate positions are often useful and necessary even in the same percolation. The support is a common apparatus stand, the rings of which are reduced to the proper size by short sections of rubber-tubing cut open and placed on the wire of the ring when needed; or, a section of larger tubing stretched over the percolator as in Fig. 3. The percolators are common lamp chimnies costing about 5 cents each, and are of the size and form known technically as "A" and "B" "Sun Chimneys." These are of very good form, though not the best, —for percolators, and should be selected with as small an opening for the stopper as possible, and with the smoothest, thickest and most regular edge, since it is practically impossible to stop some of their irregular edges tightly. The smaller size, Fig. 3, holds conveniently 4 ounces of most powders, and the larger holds 8 ounces,—to the points shown in the cut. A good soft cork, bored in the centre for a short piece of glass tube of not more than $\frac{1}{8}$th of an inch or 3mm. bore. serves to close the small end of the chimney. A rubber cork is best, and such may be made of concentric sections of rubber tubing of different sizes; or, the largest cork at hand may be increased to the proper size by stretching around it short sections of rubber tubing. The short piece of glass tubing should not go quite through the cork on the inside, and should project about an inch=25mm. outside. A piece of rubber tubing of not over $\frac{1}{8}$th inch=3mm. bore, and about 13 inches=·325m. long has one end slipped onto the glass tube. If this tubing be much larger than the dimensions given it fails to be filled with the liquid, and then when the percolator is in the position of Fig. 3, it fails to perform the office of a Sprengel pump in exhausting the liquid and air bubbles from the lower part of the percolator. Two disks of blanket or thick flannel, and one of filtering paper cut a little larger than the inner surface of the cork, and laid upon it, complete the arrangement of the percolator. The powder, moistened with great care and uniformity is packed loosely, firmly or very firmly, according to its nature or condition, with the square end of a stick, say ·8 inch =·02m. diameter. As a rule the largest practicable proportion of liquid should be used in moistening the powder, because then the powder occupies the smallest space in the percolator,—requires the loosest packing, and is saturated for the maceration by the smallest additional quantity of liquid, and therefore gives the most concentrated first percolate for the reserve, and secures the most rapid exhaustion by the

smallest quantity of liquid. A disk of filtering paper is placed on the surface of the powder, of such size that the edge is reflected up against the glass. A disk of board, card-board, or better of thick sheet rubber with a central hole 1·5 inches=·037m. in diameter, is used for a cover. A stratum of liquid, maintained at a uniform thickness of ·25 inch=·006m. should cover the powder from first to last, so that it may not drain and contract, or admit air; and this is best maintained by an inverted bottle of the supply liquid, as shown in the cut. The length of the neck and mouth of such bottle may be conveniently elongated when needed so as to regulate the depth of the stratum of liquid above the powder, by stretching over it a short section of rubber tubing in the manner shown in the first group of the cut, Fig. 1. When the percolator is charged and ready for maceration the small rubber tube is turned up and fastened with a piece of thread or rubber band so that the end is considerably above the level of the liquid in the percolator, and in so adjusting it care must be taken not to close the tube, because as the liquid decends through the powder to fill up all the interstices it is important that the interstitial air should have a free exit by the tube.

The bottles for receiving the percolate are common round-shouldered prescription bottles, 4oz. for the small percolator, 8oz. for the larger. A strip of paper should be pasted lengthwise of the bottle, and at the lower end of this the tare should be marked. It should then be graduated to the quantities desired by weighing into it the proper quantity of water and marking at each level if more than one be desired. This graduation simply serves as a reminder to know when to try the bottle on the scale, for whether the finished fluid extract be adjusted weight for weight, or by an arbitrary weight in each case so as to get the relation of minim for grain, this must equally be done by weighing.

It is convenient to have 6 to 10 of such bottles, and then as soon as 4 are filled from one percolation another can be started, and thus relieve some of the bottles for use over again. The bottles should be numbered from 1 to 10 to keep the proper order of using them, and if more than one series is in use at the same time the second should be designated by the first letters of the alphabet instead of by numbers. The maceration should never be less than 48 hours; and a longer time does not seem to be of any use unless the powder be coarse and of hard particles. When the percolation is to be started the percolator is raised

to the position of Fig. 3, and the end of the exit tube placed in the bottle marked for the reserved percolate, for 10 or 15 minutes, in order that the bubbles of air may be driven out and the tube be filled with solid liquid. As soon as this condition is attained the percolator is lowered to the position of Fig. 1, and the receiving bottle is then to be adjusted higher or lower until a rate of dropping is established of not more than one drop per minute on this small scale,—and one drop every two minutes makes a better rate for such quantities. Indeed the rule for all percolations is, the slower the rate the more perfect the exhaustion, and with a smaller quantity of menstruum.

This slow rate and the automatic supply by the inverted bottle admit the process to go on night and day, but if it be desired to go slower, that a mark may not be passed in the night, the bottle has only to be raised or the percolator lowered a little; and by a still greater change of levels the dropping may be stopped altogether. On rare occasions when dropping at a uniform rate it will stop altogether, or become very slow. This is in consequence of a bubble of air getting over the orifice of the glass tube inside, and acting as an obstruction. If the tube be moved from side to side the air bubble will be started and pass down and the rate of dropping be resumed. If not thus dislodged it will most certainly be by raising the percolator for a short time into the position of Fig. 3. With some powders, and some degrees of moistening and packing the proper rate of dropping will require the position of Fig. 2, and in some stages of many percolations this position will be required. While if for want of skill and experience the packing be too hard the position of Fig. 3 may be needed from the first. But the best percolations are those obtained by the position of Fig. 1, where the whole mass is in the equilibrium of maceration, and the fluid all moves downward together at a very slow rate. As the more concentrated portions of percolate get through, the rate of dropping increases for any position, and occasionally, with loose packing, the position has to be altered to check it. But after the reserved portion has been received, and the quantity required to moisten the next powder, the rate of dropping may be doubled without much harm, and thus half the time be saved. The slow and uniform rate of dropping is the important point to be attained, and the various positions are simply means of accomplishing this. It is easy to obtain complete exhaustion. That is, a percolate almost colorless and tasteless, and having the same s. g.

as the menstruum, and how far short of this to stop the process cannot be indicated. But upon this small scale the percolate from the first portion should weigh from 3 to 4 times the weight of the powder; and for the repercolations from 5 to 6 times the weight of the powder. And then with fair exhaustion each time the results must continually check each other and improve until after 10 or 12 repercolations, a nearly mathematical accuracy must be attained, and ever after be maintained, all the variation being in the quality of the drug used. The writer has many series of repercolation, on various scales of quantity, which were started five years ago and suspended from one season of the fresh drug to another, but never interrupted to begin anew, and such would go on indefinitely and with entire uniformity of result if the drugs could be obtained of a quality as uniform as is the process.

Should this method by repercolation become officinal, or come into general use the apparatus makers would soon supply a flat-bottomed glass percolator and cover of better form than the lamp chimneys, and of all sizes at moderate prices. If so no better form could be adopted than that shown in the following cut, if the bottom be flat or very nearly so, and the exit tube be small enough to receive a rubber tube of not more than 3mm. in bore.

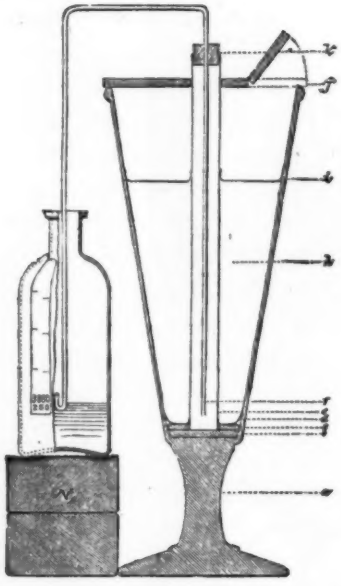
The following cut is a modification of the apparatus adapted to a rather larger scale, when the principles are applied in a slightly different way. It fulfills the purposes somewhat better than the lamp chimneys, and perhaps nearly as well in most cases as the one represented in the cut which follows it.

The chief object of presenting this illustration is to show a convenient way of applying the principles involved in the syphon percolator to the glass percolator in common use, in order to try to tempt those who have such percolators to try the method in percolation and repercolation. The cut is so plain and so easily understood that it needs but little explanation. The percolator is shown in the position of having been stopped for the night lest the receiving bottle should be filled beyond the proper mark. The syphon here is made in two parts, one end of the upper part being telescoped within a larger piece of glass tubing, and the junction made tight by a short section of rubber tubing through which the smaller tube is free to slide. During maceration, or when the percolation is arrested, the upper part of the syphon is drawn up until the liquid will no longer flow over into the bottle, and

Scale, one-sixth of the actual linear size.

the height at which this column of liquid ceases to flow over is a measure of the comparative density of the liquid within and without. As seen in the cut the liquid will not flow over into the bottle although

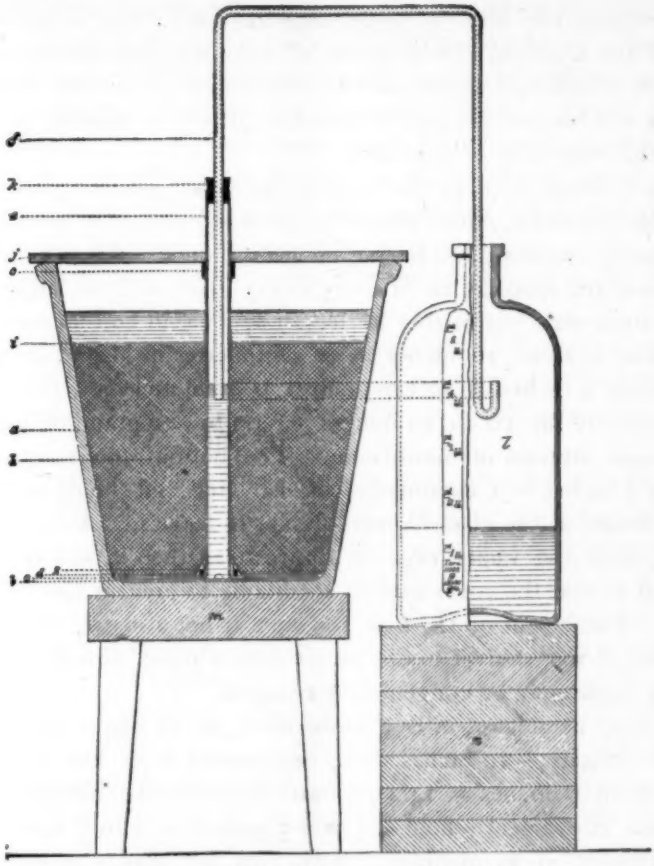
the column is several inches short of the height of the liquid in the percolator. But as exhaustion progresses, and the liquid in this column becomes less dense its counterbalancing height becomes greater, until finally when the powder is exhausted and the liquid within and without are of the same density the column rises to the level of the liquid within the percolator minus the friction and capillarity. When the percolation is to be started, the syphon is simply pushed down through the



Scale, one-sixth of the actual linear size.

rubber until the liquid flows over, and then the rate is established by carefully raising or lowering the syphon. This sliding joint for varying the length of this column of liquid at will, being understood, the other details are plain enough, whilst the charging and the general management are the same as in the smaller and larger percolators.

However attractive the simplicity of the lamp chimney arrangement may appear it does not yield so good results as the form of percolator reproduced here, with slight improvements, from the "Proceedings of the Amer. Pharm. Asso." for 1872, p. 182, for several reasons. First because the principles involved are not so well carried out, and secondly



Scale, one-sixth of the actual linear size.

because the quantity of substance operated upon is too small. Very good and uniform results need hardly be looked for when the quantity operated on for each percolation is less than an avoirdupois pound. That is when less than that quantity is used, great care and skill are necessary to get good results. Another percolator, applying the same principles by the same details, but having about five or six times the capacity of the first, was soon after made and put into use, and cuts of these two percolators are shown upon this and the opposite page, of their relative sizes, both upon a scale of one-sixth of the actual linear dimensions, the reference letters denoting the same parts in both. Of

course the principles involved when once understood can be applied to vessels of any kind and size by means of common glass tubing, and in order to have these principles tried by less prejudiced persons than the writer the mechanism will now be given as plainly as possible, as applicable to this best form of apparatus.

The percolator, *a*, is of the form of the more modern glass or tin percolators somewhat funnel shaped to allow substances to swell without becoming impacted, but having no special angle. The smaller has a glass stem and foot like an ordinary celery glass, and the larger is an ordinary stone ware pot neither having an opening in bottom nor sides. The smaller is about 16 inches = 40 centimetres in height, of which height about 4 inches = 10 centimetres is stem and foot, and is of a proper capacity for 16 to 20 ounces = 500 to 600 gram. of material and a proper stratum of menstruum. The bottom, internally should be about 2 inches = 5 centimetres in diameter and should be flat,—not cup-shaped as the glass-blowers are apt to leave it. A rim of glass is made upon the upper edge or lip, to strengthen it, and this lip is ground off so that the cover may fit accurately to prevent loss by evaporation. The height of the foot and stem is not a matter of indifference, since if too short it has to be set upon a stand in order that the receiving bottle may be conveniently changed.

The larger percolator, *a*, is a stone ware pot of about 2 gallons = 7557 cc. capacity,—10 inches = 24 centimetres high and across the top, by about 6 inches = 14·4 centimetres across the bottom, inside, and it will conveniently hold 4·5 to 6·5 pounds = 2 to 3 kilos, and a proper stratum of menstruum. Both cuts are made one-sixth the actual linear size, and the same letters refer to the same parts of each, so that one description applies to both.

A disk of blanket, *b*, is cut of such a size and shape as to lie flat upon the bottom, and cover it entirely. Another disk of the same material, but a little larger, *c*, is made with a crucial incision in the centre, so that it may be stretched over the end of the well-tube, *e*. The central or well-tube, *e*, is a simple piece of glass tube about 12 inches = 30 centimetres long, by ·5 to ·75 inch = 1·5 to 2 centimetres internal diameter, irregularly notched, or knawed off obliquely at the lower end. One end of this well-tube, *e*, is pushed through the crucial cut in the centre of the upper disk of blanket, *b*, and the blanket is pushed to the other end of the tube so that the corners made by

the crucial cut are reflected up against the outside of the tube. These corners are then tied firmly to the tube by passing twine around them, or, are secured by a stout rubber band, *g*, made of a section of rubber tubing of proper size. A disk of filtering paper, *d*, larger than the upper blanket, *c*, with a crucial cut in the centre, and nicked round the edge so as to lie flat against the sides of the percolator where reflected up against them. This disk of paper is pushed down upon the upper blanket, the well-tube passing through the crucial cut in its centre.

If now a piece of paper be twisted round the upper end of the well-tube, or a cork be temporarily stuck into it, to keep out the moistened powder, the percolator is ready to receive its charge which is packed around the well-tube and upon the disks of paper and blanket so as to occupy the main body of the percolator, *b*, up to about the position of *i*.

When the charge, having been properly moistened, rubbed, and sifted, so as to be entirely uniform and free from wet lumps, is packed around the well tube loosely or firmly according to the nature of the substance and the menstruum,—its surface is covered by a disk of muslin or paper, *i*, cut so as to lie flat and smoothly upon the surface. The object of this is to distribute the menstruum as it is poured on, and to prevent the stream from breaking up and deranging the surface. Should this disk show a tendency to float in the stratum of menstruum it may be weighted down by a few fragments of glass. The percolator is then ready to receive the menstruum or weak percolate, and a stratum of the liquid should be carefully kept covering the entire surface well until the whole mass of the substance to be percolated is entirely saturated. The cork is to be taken from the well-tube before the liquid is poured on, and then the liquid will pass down into the substance like a piston, pushing the interstitial air down before it to pass out through the blankets and the well-tube; and finally the liquid will rise in the well-tube until its surface is within an inch or so of the surface of the liquid outside.

The whole substance is now in a perfect condition for maceration, and the surface should be left covered with the liquid to the depth of at least ·4 inch = 1 centimetre. In the larger percolator a short section of rubber tubing, *o*, is stretched over the upper end of the well-tube, and slipped down so as to support the centre of the cover. A tightly fitting cover, *j*, made of sheet rubber ·25 inch = 6 millimetres

thick, with a hole in the centre for the well-tube, is then put on. If made of sheet rubber this cover fits so closely that it will soon save its cost by preventing loss of alcohol by evaporation. Its size in the larger percolator permits one side to be bent up when liquid is to be poured in. But in the smaller percolator it is very convenient to have one side of the cover cut two-thirds through from below, as shown in the cut, the undivided portion forming a good spring hinge permitting this part of the cover to be easily raised to pour on liquid. If a self-feeding bottle be used, as is generally advisable in order to keep the level of the liquid constant and thus obtain a flow at a uniform rate, it may be easily applied by making a hole of suitable size in the cover. When thus supplied and covered the maceration should continue for 48 hours at least. The whole arrangement now represents a well, dug in a wet soil of a substance to be percolated, and the proposition is, to pump out this well at so slow a rate that the liquid from outside the well coming in to supply that rate, through the disks of paper and blanket, which represent the gravel stratum of the soil,—may descend so very slowly as to be nearly frictionless. The object is, to give the whole liquid up as nearly as possible to gravitation, and to so diminish the rate of descent that the particles or portions of liquid which pass between and around the particles of solid matter may travel downward no faster than the portions of liquid which pass through the pores or interstices of the more solid substance whose soluble portions are to be washed out. Because, if the whole mass of liquid travelled downward at absolutely the same rate through a perfectly saturated mass of solid permeable substance partially soluble in the liquid, and if the molecules of liquid passed dqwnward in absolutely straight lines, through some particles, but between others, and always at a uniform rate, it is easy to see that all the first portion of the liquid would come through saturated, and all the remainder would hold nothing in solution because the substance would be absolutely exhausted by just the quantity of liquid which it was capable of saturating. The writer has on one or two occasions made percolations so slowly as to somewhat approximate this theoretical result. The dropping in one case was not over 4 drops in each 24 hours, or about a cubic centimetre every 5 days. To pump out this well at a uniform rate which can be easily controlled, is therefore the most important element in a successful percolation, and the only one which has offered much difficulty in the

past. And it can only be effectually done by means of maintaining a difference of levels in the liquid inside and outside of the well-tube. The moment a drop of liquid is taken from the well-tube, the liquid outside tends to supply its place, and will supply it in a certain definite time; and if the entire mass of liquid be under the same tension, and equally free to move through the short distance required at the slow rate required, then as liquids are practically inelastic, every drop throughout the whole mass, whether in the interstices of the solid particles or between those particles, will have moved downward through the distance and at the rate required to supply its share of the drop required to replace the one taken from the well. And if the volume of the drop be compared with the total volume of liquid set in motion, and the rate of its movement as taken out be multiplied into the mean horizontal area of the percolator, a good indication is obtained of the almost infinite slowness with which the vertical columns of molecules of the liquid descend through the mass, and the physical laws which govern percolation may be better understood.

The proposition then is to keep the total mass under a uniform tension throughout, and to do this by maintaining a difference in levels between the liquid inside and outside the well; and this difference of levels, which varies with each substance, and with every stage of the percolation of the same substance, is to be maintained by drawing liquid from the well at so slow a rate as to disturb the uniformity of tension throughout the whole mass as little as possible, so as to have the whole liquid in motion at a uniform rate like a slowly descending piston. Of course the simplest way of taking the liquid from the bottom of the percolator is the old often-used stop-cock in an opening in the bottom; but this proves objectionable for several reasons. First, it is difficult though not impossible, by means of a stop-cock at the bottom, to keep the whole mass of matter at a uniform tension, or in uniform maceration. Channels of liquid in more rapid motion are more apt to form, and the packing has to be much more carefully done in order to prevent this tendency to currents in the mass. Next, in actual practice it was found that no stopcock could be arranged to do its work automatically according to the natural requirements and varying conditions of each case. It must be arbitrarily set to run at same rate of dropping that would be decided by the judgment of the operator rather than by the natural conditions and laws of the process. Then

no stopcock could be found which would continue to run at so slow a rate of dropping with any degree of uniformity through so long a time. The smallest particle of solid matter would diminish the rate, or stop it altogether, so that it required to be continually watched or readjusted, and every change that was made disturbed the whole of the delicate balances and motions of the process. Again all the metals of which ordinary stopcocks are made are attacked by the liquids in so long a process, and have the same objection that metallic percolators have. Glass stopcocks were tried, but they were found equally liable to all the objections except the last. This experience led the writer directly to the well-tube, and to the use of a syphon, *f*, as best fulfilling all the conditions required, since it can easily be set lower or higher, to adjust the levels to the desired rate of motion, and having a free flow it works automatically and with certainty. This syphon, *f*, is made of glass tubing of about ·125 inch = 3 millimetres bore, bent twice at right angles, the two legs being about 12·5 inches = 31 centimetres long. The outer leg is a little longer than the inner one, and turned up upon itself for about ·750 inch = 2 centimetres, as shown in the cuts. The legs should have only such a difference in length that the inner one should reach the bottom of the well-tube when required, and when measured upon the outer one, should reach to about midway of the turned up end of the outer leg. This construction prevents the syphon from emptying itself at any time, for, when the liquid is drawn over by the syphon until the surface of liquid in the well-tube falls to a level with the end of the turned up portion, as shown by the lines in the cut of the larger percolator, the columns of liquid in the syphon will be of equal length, and will counterbalance each other, and therefore the flow will cease without emptying the syphon. But as soon as the level of liquid in the well is raised by fresh additions of menstruum on to the substance, the flow will recommence at a rate proportionate to the difference of levels, and may be readjusted to the required rate by slipping it up or down in the cork, *k*, in the upper end of the well-tube. This cork, *k*, should be bored to fit the syphon so tightly as to hold it in any position and should have a groove filed longitudinally on its outer side so as to allow free entrance and exit of air to the well-tube. A receiving bottle, *l*, upon which a strip of paper is pasted to receive any graduation marks that may be desired, completes the apparatus. The strip of paper on the bottle should have the tare of the

bottle in grammes and in grains marked in ink at its lower end, and should then be varnished. Then the graduation marks may be made with pencil, and be rubbed out and replaced as different graduations may be required for different substances, the graduations merely indicating when to try the weight of the accumulating percolate. A wooden stand, *m*, is necessary for the larger percolator to enable the receiving bottle to be conveniently removed and replaced without disturbing the syphon; and wooden blocks, *n*, are necessary to support the receiving bottles at various heights. As a general indication, the rate of dropping from the smaller percolator should be about 6 or 8 drops to the minute, and for the larger one about 10 to 12 to the minute. But it should always be borne in mind that the rate cannot be uniform without some self-feeding arrangement that will preserve a uniform stratum of liquid upon the surface of the substance, and that with such an arrangement, the slower the rate the more perfect, and the more economical the exhaustion will be. With a rate of 2 or 3 drops a minute the results are practically perfect, when the conditions of fineness of powder, and appropriate menstruum are properly fulfilled.

The maceration for, at least, 48 hours is useful for many reasons, chiefly that the adjustment of temperatures and solubility may take place fully and naturally:—that the particles may be thoroughly permeated by the liquid, and the liquid become saturated. And because if the maceration be omitted, the percolate, in many cases, will not be entirely bright or clear. Then as a rule, the longer the maceration within reasonable limits, the stronger will be the percolate that comes next after the maceration,—no matter at what stage of the repercolation the maceration be applied.

When the maceration is completed and the percolation to be started the syphon is put in place with about 3 inches=7·2 centimetres of the inner leg immersed in the liquid of the well-tube. Then the best way to start the syphon is by means of a piece of glass tubing of the same size as the syphon and any convenient length, armed at one end with a short section of rubber tubing of such size as to slip over the end of the turned up part of the syphon easily, but fitting tightly,—or being tied onto,—the end of the piece of glass tubing. The syphon and receiving bottle being now in position to start, the rubber end of the glass tube is passed into the neck of the receiving bottle and down till the rubber slips over the end of the turned up portion of the syphon.

Then by gentle slow suction with the mouth at the upper end of the glass tube the syphon is slowly filled, and when filled the glass tube and rubber are removed. As soon as the dropping commences the syphon must be raised or lowered until the desired rate of dropping is attained. If the syphon has to be raised in order to attain the rate, it must be done little by little in order to avoid raising the inner end out of the liquid in the well. The rate of dropping can only be established with entire uniformity when the inverted automatic feeding bottle is used for supplying menstruum, because when the menstruum is poured on from time to time the dropping will be a little faster as the outside level is raised by each addition.

When weak percolates of diminishing strength are successively used on top, the stratum of liquid should be kept thin, so that each stronger weak percolate may have nearly all sunk into the substance before the next weaker one is used. In receiving the percolate the blocks, *n*, are used to support the receiving bottle in any position, and when the percolation is to be stopped, or made to go very slowly, during the night for example, this may be effected either by raising the syphon higher, or by blocking up the receiving bottle so that the outer end of the syphon is immersed in the percolate received to the necessary depth. Of course when the receiving bottle is blocked up so that the mouth, or any desired mark upon the bottle is near the level of the liquid in the percolator, the bottle can never run over nor the mark so raised be surpassed. The dropping end of the syphon should always be inside of the receiving bottle, because thus all loss by evaporation is avoided, the air inside the bottle being still, and being saturated. If the same rate of slow dropping was carried on outside in the moving air of a room, and the drops fell into a funnel, for example, about one-fourth of the menstruum would be lost by evaporation,—the more volatile portions in greater proportion, and the percolate would be turbid and unfit for use.

The last weak portions of percolate may almost always be pushed through by the careful use of water on top, and in proportion as the operator acquires skill in the management, little menstruum will be lost. When exhaustion is practically complete the syphon is pushed down to the bottom of the well, and the last weak percolate drawn off rapidly.

Then if another portion of the same substance is to be put into the

percolator, the exhausted residue should be so removed as not to disturb the disks of paper and blanket at the bottom.

The principles of this process once well understood, modifications of apparatus will occur to many. The simplest of those that has been tried on a scale larger than the one above shown with lamp chimneys, is to dispense with well tube and syphon, and replace them with a piece of rubber tubing of small bore. One end of this is placed between the two disks of flannel near the centre of the percolator, and then the tubing is led up through any part of the packed substance, —say near, but not against the side of the percolator, as this would leave channels for liquid,—and then out over the edge of the percolator. Then a small bent portion of glass tubing is slipped into the end of the rubber so as to represent the end of the glass syphon. This end can then, by the flexibility and length of the rubber tube, be kept at any desired position. This however does not answer as well in practice as the well and syphon, nor does any other yet tried, including the simplification adopted with the lamp chimneys,—answer as well, when judged by the results obtained.

The writer made a conditional promise at the request of the Committee that he would give a table showing his own practice with fluid extracts in regard to the menstruum now used for each,—the weight of a pint of the menstruum and the weight of a pint of the finished fluid extract in each case, as bearing upon the proposed new relation of making them weight for weight instead of minim for grain, and the work for constructing such a table has been done. But this paper has grown to such an unreasonable length that it will hardly be read, and the calculations and construction of the table would require so much additional time that the writer must beg the Committee to excuse him for not presenting it.

The writer was rather opposed to the new relation of weight for weight when this point was discussed by the Committee, but now considers it practicable if the labor be given to make it fairly accurate; and believes that it might be made far more accurate than the present relation of minim for grain, this latter having proved to be rather an ideal than a practically true relation.

Brooklyn, April 16th, 1878.

On the GLUCOSIDE CHAMÆLIRIN, the BITTER PRINCIPLE of the CHAMÆLIRIUM LUTEUM, Gray.

By Francis V. Greene, M. D., U. S. N.

Read at the Pharmaceutical Meeting, April 16, 1878.

In the Unofficinal List of the U. S. Dispensatory the Chamælirium luteum is briefly described under its old name of Helonias dioica, and mention made of its having been found useful in colic, and likewise efficacious in the treatment of leucorrhœa and atony of the generative organs. The American Dispensatory, the standard text-book of the "Eclectics," edited by John King, M. D., in addition to giving a more detailed description of the Helonias dioica and pointing out the difference between it and the Aletris farinosa, which is often mistaken for it, and used in its stead, states that its root possesses the properties of a tonic, diuretic and anthelmintic; that in large doses it produces emesis, and that, when fresh, it acts as a sialogogue. The most interesting point, however, in connection with this root is its reputed action as a uterine tonic, and in consequence of this supposed property of removing abnormal conditions and imparting tone to the reproductive organs, it has been somewhat extensively used, with reported success, not only in the treatment of leucorrhœa, amenorrhœa and dysmenorrhœa, but also to correct the tendency to repeated abortion. That the chamælirium does really act as a uterine tonic is corroborated by the testimony of Dr. Braman ("Boston Med. and Surg. Journ.," xi, 416) and still more recently by that of E. H. Woodbury, M.D. ("Southern Medical Record"), who makes a very favorable report of its value in the treatment of leucorrhœa, amenorrhœa and dysmenorrhœa. With the exception of a short notice in Tilden's Supplement to the "Journal of Materia Medica," the above references embody everything of importance that is known in regard to the therapeutic action of this plant. No chemical investigation appears to have been made, and, as we are entirely ignorant of the nature of the principle or principles which produce the observed effects on the economy, an inquiry in this respect seemed desirable, not only in consequence of its therapeutic action, but likewise on account of the plant being so closely allied botanically to the veratrums, with which it was originally classed by Linnæus, under the name of the V. luteum. I have therefore lately examined the the root of Chamælirium lutuem, and have succeeded in extracting from it in a pure state quite a large amount of a very bitter substance, of a

light buff color, which proves to be a glucoside, and which I propose to call *chamælirin*, to distinguish it from helonin, the so-called neutral substance of the "Eclectics," which, according to King, is merely a "hydro-alcoholic extract" of the Helonias dioica.

In making this examination, in the first instance four troyounces of the powdered chamælirium root were exhausted with cold distilled water, the filtered solution placed on a water bath, evaporated to one-half its bulk, calcined magnesia added, and the evaporation continued until the mass was dry, when it was powdered, and extracted with several portions of ether. On evaporating the ethereal solution, there remained a small quantity of a white substance, which was amorphorus, and insoluble in water, acids and ammonia, but readily soluble in alcohol. The mass which had been exhausted with ether, was then extracted with absolute alcohol, and the solution, which was of a light yellow color, filtered. After the evaporation of the alcohol, there remained a light yellow, transparent, resinous matter, having an intensely bitter taste, and which dissolved completely in water. The aqueous solution was found to be quite neutral, and did not give any reactions with the ordinary tests for the alkaloids, with the exception of phosphomolybdic acid, with which it gave a flocculent yellowish-white precipitate. Boiled with Fehling's solution, it however quickly reduced the copper. A small quantity of an aqueous infusion of the root was then added to the test solution, and boiled, when the copper was converted into the red oxide, showing conclusively that glucose existed in the root.

Believing that with care in drying the magnesia mass thoroughly, the bitter principle could be extracted free from glucose, or if not, with the intention of removing it from the alcoholic solution by the addition of the proper amount of ether, eight troyounces of the finely powdered root were exhausted with water, the filtered solution treated as before with magnesia, evaporated to dryness, the mass powdered, again heated on the water-bath, and then placed in a warm closet for some hours. The bitter principle was then extracted with hot absolute alcohol; the filtered solution was evaporated, and yielded 20 grams of the bitter principle which, tested with Fehling's solution, proved to be entirely free from glucose. The magnesia mass was then treated with hot distilled water, and the filtered solution evaporated to dryness with a little magnesia, and this mass again extracted with absolute alcohol. On evaporating the alcohol, 2·65 grams more of the bitter substance were obtained.

The sum of the two extractions amounting to 350 grains, it follows that 9·1 per cent. of chamælirin had been extracted, so that, making allowance for the root not having been probably thoroughly exhausted, and for unavoidable loss, it is safe to conclude that the root contains fully 10 per cent. of the bitter principle. The mass remaining after the extraction by absolute alcohol, was then exhausted with hot alcohol of 70 per cent. To this solution, after cooling and filtering, an equal volume of ether was added, which caused the precipitation of a molasses-like liquid which, treated with Fehling's solution, gave the appropriate reaction for glucose.

Distilled water was then added to the whole of the bitter substance, but as it agglutinated after the manner of gum arabic, heat was applied, which caused it to dissolve rapidly, although the quantity was so small as to give the clear solution a syrupy consistence. On diluting the solution with water, it was noticed that as the liquid cooled it became slightly turbid. It was therefore still further diluted, and set aside for twelve hours, when it was found to have deposited a small quantity of a white substance, which, separated by filtration, dissolved in hot water, alcohol and ether, but not in acids or alkaline solutions. A small quantity of this substance dissolved in ether, gave upon evaporation the same white, opaque film that was observed in the case of the substance dissolved out of the magnesia mass by ether in the first experiment.

As the filtrate from this white substance was still slightly cloudy, animal charcoal was added to it, and after agitation, it was filtered, yielding a perfectly clear solution. The use of the charcoal proved in the first place that the white substance is retained by it, and secondly that it does not remove any of the color from the chamælirin. Subsequent experiment showed that the use of the charcoal was not essential, as by proper dilution, and allowing sufficient time for subsidence, the solution can be filtered off perfectly free from the white substance, provided that the washings are not added to it as the insoluble matter passes through the pores of the filter when pure water is added. Another and still better plan of overcoming the difficulty, occasioned by the presence of this substance, is to take advantage of its solubility in ether, and by using this menstruum to remove it from the magnesia mass before exhausting with absolute alcohol.

The clear solution of chamælirin was then evaporated to dryness on a water-bath, yielding an opaque, amorphous mass of a light buff

color. It is very readily reduced to a powder, which is very much lighter in color than the substance in mass. This powder adheres to the fingers after the manner of a resin. As may be gathered from the method of extraction, chamælirin is freely soluble in hot and cold water and alcohol. It is insoluble, or only very sparingly so, in ether, and quite insoluble in chloroform, petroleum benzin, benzol and bisulphide of carbon. The solid substance gives no play of colors when brought in contact with sulphuric, nitric or hydrochloric acids. When, however, sulphuric acid is added to a small quantity, in a test tube, at the moment of contact a ruby-red color is produced, which soon disappears, as the substance is quickly charred by the acid. Treated similarly with nitric acid, it dissolves in it, giving a clear canary-yellow solution, which does not change by standing. Hydrochloric acid dissolves it, the solution gradually assuming a beautiful wine or peach-red color; the liquid, however, becomes turbid after a short time. Its solution in acetic acid is colorless. It does not afford any play of colors with Fröhde's reagent, but dissolves in it with a yellowish-brown color. It is freely soluble in ammonia; but strong solutions of the fixed alkalies precipitate it from its solution. It is also precipitated by an excess of a solution of caustic baryta. It has no effect whatever on test papers. It is not precipitated from its solution by either tannic acid or acetate of lead, and affords no precipitates with potassio-mercuric iodide, iodine in iodide of potassium solution, potassio-cadmic iodide or metatungstic acid; it does, however, give a yellowish white precipitate with phosphomolybdic acid, which dissolves in ammonia with a blue color, that disappears on heating. It does not reduce the cupric to the cuprous hydrate, even after prolonged boiling with the test solution. A small portion of the substance, boiled with dilute hydrochloric acid, neutralized with bicarbonate of soda, and then added to Fehling's solution and boiled, quickly reduced the copper, showing that it is a glucoside. The dilute acid splits it up into glucose and an insoluble body, the examination of which has not been completed.

The aqueous and alcoholic solutions of chamælirin froth in the same manner as those of saponin, which renders it probable that it is very similar to the last-named substance and the other glucosides that have the same property. Its free solubility in cold water, and its behavior with the mineral acids prove, however, that it is not identical with any of these bodies.

GLEANINGS FROM THE FOREIGN JOURNALS.

BY THE EDITOR.

The Free Acids of the Gastric Juice.—By repeated treatment of gastric juice with ether, Ch. Richet has separated an acid which was recognized as identical with *sarcolactic acid*, prepared from horse-flesh; its zinc salt resembles the corresponding salt with the ordinary lactic acid (obtained by fermentation), but the calcium salts of the two acids differ in cyrstalline form; however, the sarcolactate, when kept for some time, assumes the aspect of the ordinary lactate of calcium, probably by a change in hydration. The ether also took up small quantities of fatty acid; the nature of the acid insoluble in ether will be investigated by the author.—*Jour. de Phar. et de Chim.*, Feb., 1878, p. 109.

Iodide of starch, according to Bondonneau, is always a definite compound, having the formula $(C_{12}H_{10}O_{10})_5I$ (O=8). To obtain it pure, soluble starch is prepared by acting with caustic soda upon starch diffused in 15 to 20 times its weight of water; after slightly acidulating the solution, a solution of iodine is added in slight excess and the precipitate well washed with water, acidulated with HCl, and dried at the ordinary temperature.

It is in hard pieces, of a violet-black color and coppery lustre It swells in water, and when diffused in it appears blue. At 100°C. it loses 16 to 18 per cent. (H_2O and HI), becomes carbonized and is not decolorized by sulphite of sodium; the loss is increased to 46 per cent. by heating to 190°C. (374°F.), and the black residue then contains 2 to 3 per cent. of iodine. When heated with water, in a sealed tube, it is gradually, almost completely converted into glucose and hydriodic acid. A similar conversion, including dextrin and an iodated organic compound, is produced by diastase and by saliva. The iodine is dissolved by alcohol, but not by potassium iodide, benzin, sulphide of carbon or other solvents. Iodide of starch contains 13 per cent. of iodine, a portion of which is slowly eliminated by drying over sulphuric acid —*Ibid.*, p. 121.

Oil of tansy consists, according to Bruylants, of a small quantity, (about 1 per cent.) of hydrocarbon $C_{10}H_{16}$, four-fifths of an aldehyd, *tanacetyl hydrid*, $C_{10}H_{16}O$ and of an alcohol $C_{10}H_{18}O$. The aldehyd is best separated by sodium bisulphite Two resins were also found, one of which had the behavior of an acid.—*Jour. de Phar. et de Chim.*, Nov., 1877, p. 393.

Proximate Principles of Lobelia Inflata.—Wm. H. D. Lewis obtained the alkaloid in a pure state by exhausting the herb with very dilute acetic acid, concentrating the infusion, treating with magnesia and agitating with amylic alcohol, on the spontaneous evaporation of which lobelina remains behind. It may be further purified by dissolving in water, passing through animal charcoal, which retains it, and dissolving it by ether or amylic alcohol. It is light-yellow, of the consistence of honey, has a somewhat aromatic odor and a sharp acrid taste, and is soluble in all simple solvents, sparingly in petroleum naphtha. It is decomposed by caustic alkalies and cannot be distilled. Exposed to the air, it slowly resinifies. H_2SO_4 colors it red-brown, the color being intensified by potassium bichromate. Fröhde's

reagent has the same behavior. Continued boiling with dilute H_2SO_4 liberates glucose; dilute potassa has the same result.

Lobelic acid is obtained by precipitating the decoction with sulphate of copper, decomposing by H_2S, evaporating and exhausting with hot ether; on evaporation a yellow crystalline mass is left, which is purified by dissolving in cold ether. The acid is not volatile and dissolves in ether, alcohol and water, the aqueous solution being precipitated green by copper sulphate, brown by ferric chloride, yellow by lead acetate, dirty-white by mercuric nitrate, and white, becoming red-brown, by silver nitrate. The *lobelacrin* of Enders ("Pharmacographia," p. 357) is regarded by the author to be lobelate of lobelina.

The aqueous distillate of the plant possesses the odor, but not the acrid taste of lobelia. Reinsch's *lobeliin* is evidently a very indefinite compound, and possibly contains traces of lobel na.—*Phar. Jour. and Trans.*, Jan. 19, p. 561.

Solubility of Sugar in Water.—H. Courtonne confirms the results, previously obtained by Berthelot and Scheibler, that 100 grms of water dissolve at 12·5°C. (54·5°F.) 198·647, and at 45°C. (113°F.) 245 grms. of sugar. A solution, therefore, saturated at 12·5°C. contains 66·5, and when saturated at 45°C., 71 per cent. of sugar.—*Compt. Rend.*, lxxxv, p 959.

Ointment of thymol has been used by Balmanno Squire for ringworm; it was prepared by melting thymol ℥i at the temperature of a water-bath and mixing it with lard ℥i. When of this strength, the ointment did not produce irritation of the skin or any other evil effect.—*Phar. Jour. and Trans*, Feb. 2, p. 602.

Thymol and its Pharmacy.—Thymol is produced from several labiatæ, principally from Thymus vulgaris, Monarda punctata and Ptychotis ajowan. It is in nearly transparent and colorless irregular crystals, sp. gr 1·028, of a burning and aromatic taste. It fuses at about 44°C. and often remains liquid for several days or until brought in contact with a crystal. It is freely soluble in alcohol, ether, chloroform, benzol, carbon bisulphide, oils and in potassa and soda; it dissolves sparingly in water, glycerin and ammonia. Ether, shaken with the alkaline solutions, removes the thymol entirely.

A. W. Gerrard found that the strongest aqueous solution of thymol available is 1 in 1,000. 4 grains of it dissolved in a fluidounce of rectified spirit will yield an alcoholic solution miscible with water without becoming turbid. 1 grain dissolved in 2 fluid drachms of heated glycerin remains clear on cooling, the solution becoming turbid on the addition of water until four volumes of the latter have been added, when it is clear again. 1 grain of caustic soda dissolves 3 grains of thymol and 1 grain of potassa 2½ grains of it; the solutions remain clear when diluted with water. Fats and oils are excellent solvents of thymol, but require to be heated to insure perfect solution. Vaseline is not an eligible basis for it, the thymol crystallizing upon the surface of the mixture.—*Ibid.*, Feb. 16, p 645.

Commercial Oil of Thyme.—A. W. Gerrard attempted to prepare thymol from the oil by agitating it with soda solution, but obtained variable quantities of an oily liquid differing from thymol. When placed in ice the oils did not separate any

crystalline matter. This leads to the inference that the thymol must be extracted in the countries where the oil is produced, and that the residual cymene and thymene is sold as oil of thyme.—*Ibid.*, p. 646

Garcinia indica, known in India as *Kokum*, flowers about Christmas and ripens its fruit in April and May. Dymock states that the fruit is largely used as an acid ingredient in curries as is an article of commerce in the dry state. It is generally prepared by removing the seeds, drying the pulp in the sun and slightly salting it. The seeds are pounded and boiled to extract the fat, which is roughly moulded by hand into egg-shaped balls or concavo-convex cakes, and is known as kokum-butter. The apothecaries of Goa prepare a very fine purple syrup from the fruit, which is worthy of attention —*Phar. Jour. and Trans.*, Jan. 19, p. 565.

Elemic Acid.—In addition to bryoidin and amyrin, Eugene Buri has separated a third crystalline principle from elemi. It is obtained from the mother liquors of amyrin ("Amer. Jour. Phar.," 1876, p. 355), by evaporating them The amorphous resin is dissolved in petroleum spirit (60°C. boiling point), the solution becomes turbid with more petroleum spirit. The mixture is shaken with potassa solution, and after separation the jelly is emulsionized by the addition of some water, and then dissolved in ether. Instead of petroleum spirit, ether may be used for dissolving the resin. On supersaturating the alkaline solution with HCl, elimic acid is precipitated and freed from an amorphous acid resin by repeated crystallization from alcohol. Its composition is $C_{35}H_{56}O_4=(C_5H_8)_7O_4$. The potassium salt crystallizes from its strong alkaline solution in needles.—*Ibid.*, Feb. 2, p. 601.

Spurious balsam of tolu has been observed by W. A. H. Naylor. It is yellowish-brown, very viscid, in thin layers of golden yellow and transparent; has a somewhat glue-like odor, and when tasted produces in a few seconds a sensation of warmth and acridity. It is completely soluble in carbon bisulphide, benzol, chloroform, ether and hot alcohol, the latter solution depositing on cooling. Glacial acetic acid and potassa solution dissolve it partly. It contains no constituent volatile at 160°C, and when distilled with potassium bichromate and sulphuric acid, no oily liquid passes over, and the odor of bitter almonds is not evolved. Agitated with ammonia and the filtrate acidified with dilute sulphuric acid, a pink color is quickly developed. It was free from fixed and volatile oils, and found to consist of an indifferent and two acid resins The author suggests the probability that this substance is a natural product of new importation, and not a tampered or manufactured article.—*Ibid*, Feb 9, p. 624.

Artificial Vanillin.—Tiemann has patented a process in England which depends upon the conversion of eugenic acid into aceto-eugenol by boiling with acetic anhydrid. The newly formed compound is treated with a very weak warm solution of potassium permanganate, the solution filtered, rendered slightly alkaline, concentrated, acidulated and the vanillin extracted with ether.—*Ber. Deutsch. Chem. Ges.*, 1877, p. 1907.

Distillation of Resins with Zinc Dust.—This was effected by G. Ciamician in a current of hydrogen, and the products separated by fractional distillation. *Abietinic acid* yielded under these circumstances toluol, C_7H_8, meta-ethylmethylbenzol C_9H_{12},

naphthalin, $C_{10}H_8$, methylnaphthalin, $C_{10}H_{11}$ and methylanthracen, $C_{15}H_{12}$. *Colophony* yields the same products, but toluol in much smaller proportion. *Resin of benzoin*, freed from extraneous matter and benzoic acid, similarly treated, yielded toluol, xylol, naphthalin and methyl naphthalin.—*Ibid.*, 1878, 269.

Cubebin, $C_{10}H_{10}O_3$, according to H. Weidel, is by nitric acid converted into oxalic and picric acids, while it yields, with nitrous acid, small yellow crystals of $C_{10}H_9(NO_2)O_3$, which are soluble in ether, alcohol, ammonia and potassa; the latter solution having a purple color. If cubebin is dissolved in chloroform, and bromine added, drop by drop, $C_{10}H_7Br_3O_2$ separates, which is insoluble in the common solvents, and obtained in white crystals from boiling xylene. When fused with HKO, carbonic, acetic and protocatechuic acids are obtained; the same products were yielded, under similar circumstances, by ferulic acid and eugenol, into which compounds, however, cubebin could not be converted.—*Wien. Akad. Ber.*, lxxiv, p. 377.

Medicinal Plants of Liberia.—E. M. Holmes describes the following: *Ocymum viride*, Willd., nat. ord. *Labiatæ*, fever plant, is a shrub, three feet high, with ovate, lanceolate acuminate leaves, 1 to 2 inches long, crenate at the margin and abundantly dotted underneath with oil glands. It has a strong odor like lemon thyme, and possibly contains thymol. Dr. Roberts states that in Liberia it is the common remedy for fever of any kind, and that he has entirely substituted it for quinia in his practice, since it is much cheaper and equally as effectual. It is given in the form of infusion in wineglassful doses until perspiration is freely induced, the patient being kept warm in bed.

Aspilia latifolia, O. & H., nat ord. *Compositæ*, hæmorrhage plant, is an herb 1½ to 4 feet high, with the leaves opposite, very rough, ovate, acuminate, minutely serrate and very hard to the touch, being covered with short rigid hairs; the flowers are yellow, with neuter ray florets and almost obsolete pappus. The fresh leaves and flowers are pounded together and applied to the wound, the hæmorrhage stopping in a few minutes and the wound healing rapidly without other application. The decoction, in doses of ℥ss 3 times a day, is used in hæmorrhage from the lungs.

Cassia occidentalis, Lin., nat. ord. *Leguarinosæ*, small senna.[1] The leaves are used in Liberia as a purgative. Larger leaves, probably of a Croton, are known there as *large senna*.

Scopariadulcis, Lin., nat. ord. *Scrophulariaceæ*, pipybras. The plant is used for gravel and kidney complaints, in the form of infusion.

Erythrophlæum guineense, Don. Sassybark is used only as a poison. (See "Amer. Jour. Phar.," 1877, p. 32.)—*Pharm. Jour. and Trans.*, Jan. 19, p. 563.

Detection of Adulterations of Butter.—All animal fats, with the exception of butter, consist of tristearin, tripalmitin and triolein, and therefore yield between 95·23 and 95·73 per cent. fatty acids, while pure butter yields between 85·4 and 86·2, occasionally 87·5 per cent. O. Hehner regards butter as adulterated if it yields

[1]The plant has been naturalized in the Southern United States.—EDITOR.

over 88 per cent of fatty acids. The determination is made by fusing the butter and freeing it completely from water, salt and casein; about 4 grms. of it are then completely saponified by alkali in the presence of alcohol, the solution of soap is concentrated, the residue taken up in about 150 grms. of water, decomposed by muriatic acid and the fatty acid washed, dried and weighed.—*Zeitschr. Anal. Chem.*, xvi, 145.

Husson dissolves the butter in 10 times its weight of a mixture of equal parts of 90 per cent. alcohol and ether at a temperature of 35 to 40°C. (95 to 104°F.). The solution is set aside for 24 hours at a temperature of about 18°C. (64·4°F.) and the separated solid fat, of which pure butter yields not over 40 and not less than 35 per cent, is collected and weighed. If more than 40 per cent., the butter is adulterated with tallow or suet; if less than 35 per cent., lard, goose grease or similar fats are present.—*Jour. de Phar. et de Chim.*, Sept., 1877, p. 100.

Preparation of Indigo Carmine.—V. Joclét gives the following process: 1 kilo of powdered good Bengal indigo is gradually added to 5 kilos of strong sulphuric acid, heated in a water-bath to 45 to 50°C. (113 or 122°F.) When dissolved, the liquid is poured into a suitable vessel, and for every kilo there is slowly added a solution of 3k. of clear crystallized sal sodæ dissolved in 30k. of water. The mixture is occasionally stirred during 12 hours to facilitate the extrication of the carbonic acid gas, set aside for some time, and then passed through a woolen filter, the filtrate being collected. The contents of the filter are transferred to a vessel with an inner perforated bottom, upon which a woolen strainer is placed, and more indigo carmine solution obtained and withdrawn by means of a stopcock. Finally indigo purple remains upon the filter.—*Chem. Cent. Bl.*, No. 10, *D. Färber-Z.*, 1877.

Preparation of Phosphorous Acid.—I. Corne recommends to partly immerse phosphorus in distilled water, and after several days' exposure precipitate the phosphoric acid from the liquid by the addition of ammonia, ammonium chloride and magnesium sulphate. The filtrate is heated to expel excess of ammonia, and then mixed with acetate of lead, whereby sulphate, chloride and phosphite of lead are precipitated. The precipitate is well washed and, at a moderate heat, digested with ammonium acetate, whereby the two former salts are dissolved, while the lead phosphite remains behind, and after washing is decomposed by sulphuretted hydrogen. The solution is filtered, heated to expel H_2S, and now contains pure phosphorous acid.—*Jour. de Phar. et de Chim.*, Feb., 1878, p. 100.

Persulphuric acid, S_2O_7, is a new acid, which has been obtained under the influence of electricity upon a mixture of dry sulphurous acid gas and oxygen; it crystallizes at a low temperature in transparent needles. It may also be obtained in the form of solution by carefully mixing chlorine water with concentrated sulphuric acid, but is not formed if the latter contains more than 2 equiv. of water. Under various conditions the new acid may be obtained from concentrated sulphuric acid, perhaps also by acting with the latter upon alkaline or metallic peroxides in the cold.—*Ibid.*, March, 168.

Santonin.—The fusing point of santonin is given by the French Codex at 136°C., by the German Pharmacopœia at 170°C. H. Leroy has examined commercial santonin and such prepared by himself, and found both kinds to have the fusing point 170°.5C. (339°F.)—*Rép. de Phar.*, March, 104.

Hydrobromate of quinia has been used with success in whooping cough, the paroxysms diminishing in frequency and severity in about a week. Dr. Steinitz ordered 0·3 to 0·5 grms. of the salt to 100 grms. of syrup to be given in teaspoonful doses every two hours.—*Allg. Med. Cent. Zeitung.*

Tasteless tannate of quinia is obtained by **A. Bernick** by mixing 20 parts of sulphate of quinia with 600 parts of distilled water, having a temperature of 60 to 70°C. (140 to 158°F.), and carefully adding dilute sulphuric acid, with the precaution to leave a few floccules of the quinia undissolved. To this is slowly added, and with continued stirring, a cold prepared solution of 60 parts of tannin in 600 parts of distilled water. The precipitate is collected upon a filter, washed with 100 parts of distilled water, and dried upon bibulous paper at the ordinary temperature. The yield is 70 parts. The filtrate contains a little tannin, but not a trace of quinia. The process is a modification of the one adopted by the German Pharmacopœia.—*Phar. Zeitung*, No. 30.

Curarina, the poisonous alkaloid of curare, according to Sachs, has the composition $NC_{36}H_{35}$, and is present in the form of sulphate.—*Liebig's Annalen*, vol. 191, p. 254, Feb., 1878.

Apomorphia, of English manufacture, was found by Patrouillard to be a voluminous powder of grey color, intermixed with blackish granules. Under the magnifying glass it appeared as glossy scales. It has a slightly bitter taste, is soluble in water, alcohol and ether, and is colored dark-red to violet by nitric acid, the color becoming gradually lighter and the mixture sticky, but thin again and brown on the addition of ammonia. Ferric chloride colored it rose-red, the color changing to violet and finally black. The aqueous solution yields with solution of iodine a red precipitate which dissolves on heating and colors the solution red, afterwards brown. The aqueous and alcoholic solutions of the alkaloid are at first colorless with a greyish tint, but on exposure to the air become greenish and finally emerald-green. —*Zeitschr. Oester. Apoth. Ver.*, No. 9, from *Jour de Phar. et de Chim.*, 1877.

Adulterated lard has been met in the German market by **E. Heintz**, and was found to contain 22 per cent. of water. The lard was imported from two firms in Amsterdam and was branded "E. Milnor & Co., New York." The author believes that the adulteration was made in Holland.—*Phar. Zeitung*, No. 30.

Application for Sore Nipples.—Dr. Haussmann, of Berlin, recommends a 5 per cent. solution of carbolic acid, which is applied lukewarm by means of linen.—*Ibid.*

Administration of Creasote.—Tournier recommends cod liver oil for masking the caustic taste of creasote and facilitating its digestion. He gives it in capsules containing 02 grm. ($\frac{1}{3}$ grain) mixed with ·50 grm. ($7\frac{1}{2}$ grains) of cod liver oil. To be given by the spoonful, this solution should be more dilute, so as to contain 1

grm. of creasote to 150 grms. of cod liver oil. He also recommends a *wine of creasote* made by dissolving 6 grms. of creasote in 125 grms. of alcohol, and adding 400 grms. of simple syrup and sufficient Malaga wine to make 1 liter. This is weaker, but preferable to that made by Bouchard's formula, which contains in the same measure 13·5 grms. of creasote and 30 grms. of tincture of gentian, but no syrup.—*Rép. de Phar.*, 1878, p. 98.

Oil of rose geranium, *Pelargonium rosatum*, according to Jaillard, is freely soluble in 70 per cent. alcohol. Since the fixed and most volatile oils which may be used for adulteration are sparingly soluble in that liquid, they may be readily detected by mixing in a test tube 6 drops of the suspected oil with 5 cubic centimeters of 70 per cent. alcohol. After agitation the solution must be complete.—*Jour. de Phar. et de Chim.*, March, 206.

To Detect Cotton Fibre in Linen.—The fabric is well washed, dipped into an alcoholic solution of rosolic acid, known in commerce as aurin or yellow corallin, afterwards immersed in a concentrated aqueous solution of sodium carbonate and finally washed; the linen fibre is dyed rose-red by this treatment, while cotton remains white.—*Phar. Zeitung*, No. 18—*Polyt. Notizbl.*

Impressions from Plants.—A piece of paper is saturated with oil, folded to 4 thicknesses and subjected to great pressure to facilitate the uniform absorption of the oil. The plant or leaf is now placed between the oiled paper, moderately pressed, then removed to clean paper and again pressed. This last paper is afterwards dusted over with finely powdered plumbago or, better still, with a mixture of rosin and plumbago; on warming the paper with the adhering latter admixture a permanent impression is obtained.—*Apotheker. Zeit.*, No. 9—*Industriebl.*

MINUTES OF THE PHARMACEUTICAL MEETING.

PHILADELPHIA, April 16, 1878.

In the absence of the President, Mr. Wm. McIntyre was called to the chair; the minutes of the last meeting were read and approved. Prof. Maisch corrected a statement he had made at the last meeting in regard to the tincture of protochloride of iron, and said that it was made officinal in the German Pharmacopœia of 1872, and prepared by dissolving 25 parts of the recently prepared protochloride of iron in 225 parts of diluted alcohol (sp. gr. 0·892), adding 1 part of pure hydrochloric acid, and filtering.

Prof. Maisch presented from Dr. F. V. Greene, U. S. N., a specimen of oil of Tucumá (from the Astrocavyum tucumá), also a specimen of the oil of Batiputá (Gomphia parviflora, *Mart.*), both from Brazil. The former appears not to be employed medicinally, but the fruit is eaten by the Indians, and the fibres of the plant possess great tenacity. The latter is used in place of olive oil and medicinally as an embrocation in rheumatism and erysipelas.

A paper by Mr. Alonzo Robbins upon *Maté*, the Ilex Paraguayensis,[1] was read and samples of the different commercial varieties of the drug were exhibited Remarks were made upon the uses of *maté* and of the North American *yaupon* tea (Ilex cassine, *Lin.*) The patient labor bestowed by Mr. Robbins upon his researches was commented upon, and on motion the thanks of the meeting were directed to be returned to the author.

A member reminded the meeting that various committees of the College were now engaged in the preliminary revision of the Pharmacopœia, and a typical formula was exhibited, showing the manner in which the formulas were proposed to be reported. The formula shown was for Confectio Opii.

Take of Opium in very fine powder, . . .	3 parts
Aromatic Powder, ...	37 "
Clarified Honey, ...	60 "
	100 parts

Parts by weight in all cases are designated.

The advantage of this manner of representing the formulas was evident, as the ratio of the active ingredient to the entire amount is seen at a glance, the quantity resulting being exactly 100 parts.

A paper by Dr. F. V. Greene, U. S. N., was read on *chamælirin*, a bitter, neutral glucoside, isolated by the author from *Chamælirium luteum*, Gray. Samples of the rhizome of this plant and of *Aletris farinosa* ,Lin., were exhibited, both of which are sometimes called *blazing star*, a name more generally applied to *Liatris squarrosa* Willd. The extremely bitter new glucoside was likewise exhibited, and its behavior to various solvents and reagents illustrated. On motion, a vote of thanks was tendered to Dr. Greene for the interesting communication.

A paper upon Emulsions, by Mr. L. von Cotzhausen, was then read; the various processes described were illustrated by samples of the results of the different formulas, some of the emulsions being two months old. This paper elicited a great deal of comment, several members detailing their experience with the different processes.

An inquiry was made regarding the preparation of pills of salicylic acid by compression, the inquirer relating the difficulty he experienced in freeing perfect pills from the press. Prof. Remington ascribed the difficulty to the dryness and non-adhesiveness of the material, and mentioned that the addition of a small quantity of powdered soap, exposure to a damp atmosphere by placing in a tight box which has been filled with steam from boiling water, rubbing the end of the plunger and lower die with paraffin, oftentimes would remedy the difficulty.

Prof. R. called attention to a plan for preserving prescriptions which he had used with great satisfaction, and referred to a contrivance for the same purpose, designed by W. H. Naulty, Little Rock, Ark, which, however, he had not yet seen. He uses Mann's Binder; the prescriptions may be either temporarily or permanently

[1]The papers by Mr. Robbins and Mr. Cotzhausen will be published in the June number.—EDITOR.

bound, and the facility with which reference may be had in case of renewals amply repays the small expense and the use of the long brass-wire file, which always mutilates and affords no protection from dirt, dust and flies. When permanently bound the prescriptions have the appearance of regularly bound volumes.

Prof. Maisch exhibited a number of seeds, which when polished and mounted have been quite popular as "charms"; they are known as "sea-beans," because they are washed ashore on the coast of Florida and other States on the Gulf of Mexico; they are yielded by a tree which is indigenous to the West Indian islands. The seeds are known in Cuba as *Ojo de buey*, or bull's eye, but the "ox eyes" noticed by Grisebach are very different. A recent writer in the "Scientific American" said that the sea-beans were the product of Cytisus arboreus, of Sloane; but the plant noticed by De Candolle under this name is a native of Algeria.[1]

There being no further business, a motion to adjourn was carried.

T. S. WIEGAND, *Registrar.*

PHARMACEUTICAL COLLEGES AND ASSOCIATIONS.

Alumni Association of the Massachusetts College of Pharmacy.—At the monthly meeting, held March 7, Prof. Babcock gave an account of his recent visit to the Bahama Islands, and exhibited a large number of seeds and other vegetable products, among them the so-called *sea-bean*, or *black-eyed Susan* (see above). He showed a letter written two months previous with the red juice of the *prickly pear*, the fruit of the cochineal cactus, and said that it would be interesting to ascertain what relation, if any, existed between the coloring matter of the juice and that of the insect which feeds upon the branches of the cactus. He described the *banyan*, or *wild fig*, with its numerous aërial roots growing from the branches and having the appearance of trunks; also the *vegetable sponge*[2], so-called from the entangled fibres of the fruit, which is shaped like a cucumber, the fibres being a poor substitute for the sponge; also the *sand-box*, being the fruit of a large tree[3] shaped like a tomato, and when ripe bursting with a loud report and throwing the seeds to quite a distance. He exhibited specimens and described the products of the *arnatto shrub*[4], the *cowage bush*[5] and many useful fruits growing there, among the latter one called *archee*, or *arkee*, containing a pulpy substance, eaten by the negroes, black kidney-shaped seeds and a peculiar juice, which is used as an indelible ink; it is yellow when first applied, but rapidly becomes darker and is very permanent.

A vote of thanks was tendered to Prof. Babcock for his very interesting and instructing discourse.

[1] The so-called *sea-bean* undoubtedly comes from *Mucuna altissima*, D. C., the fruit and seed of which are described in Grisebach's "Flora of the West Indian Islands" as follows: "Legume 6 inches long, 1½ inch broad below its pointed top, callous on the margins, rusty, hirsute. Seeds orbicular compressed, 8 to 10 lines diam., almost wholly surrounded by the rhaphe. Hab. Jamaica! *Wils.* rare, in mountain woods, Manchioneel (French islands; Panama! Brazil.)—EDITOR.

[2] Luffa spec. [3] Hura crepitans, *Lin.* [4] Bixa orellana, *Lin.* [5] Mucuna pruriens, *Lin.*—EDITOR.

At the meeting held April 4, Mr. Sheppard introduced the subject of the growing habits of physicians to prescribe non-officinal and proprietary articles; in the discussion it was urged that efficient and equally elegant preparations should be made officinal, or prepared by the pharmacists for their use.

Mr. Sheppard gave a brief history of the patented articles cosmoline and vasaline, and similar preparations of the so-called *neutral oils* of the petroleum products. He stated that Mr. Chas. Toppan, of Wakefield, Mass, had at last succeeded in obtaining a similar article without infringing on any patent. It is made by throwing the heavy residue left in the still, the same material from which the articles mentioned are made, in the form of spray, into a current of live steam; the resulting product, which has but a very slight petroleum odor, is made by the Binghampton Oil Refining Co., of Binghampton, N. Y., and can be furnished for about 25 cents a pound.

Mr. Sheppard also exhibited some specimens of *pure wax*, one made by direct heat, the other by the aid of a water-bath, the latter being much lighter and handsomer; 75 lbs. of comb honey had yielded only 1 lb. 9 oz.

The subject of *coating pills* extemporaneously was introduced by Mr. Kelley; the meeting did not favor a coating of tolu, as being insoluble in the fluids of the stomach.

In some remarks on making *dialyzed iron* it was stated that Mr. Lowd uses as a dialyser a glass lamp shade, and Mr. Kelley an inverted glass funnel.

National College of Pharmacy, Washington, D. C.—At the annual meeting, held in April, the usual routine business was transacted and the following officers were elected for the ensuing year, viz.:

President, John A. Milburn; Vice-Presidents, J. S. Jones and J. R. Major; Secretary, Chas. Becker (Georget'n); Treasurer, W. G. Duckett; Additional Trustees, Messrs. Cromwell, O'Donnell, DeMoll, Scala, Thompson, Fill and Lewis. Messrs. Oscar Oldberg, W. S. Thompson and R. B. Ferguson were elected delegates to the Pharmaceutical Convention of 1880.

The Georgia Pharmaceutical Association held its third annual meeting in Augusta on the 9th of April, President R. H. Land in the chair, and W. A. Taylor Secretary. Mr. H. P. Tarrant, on behalf of the druggists of Augusta, extended a hearty and cordial welcome, which was responded to by Mr. Th. Schumann, of Atlanta. A large number of members were elected, after which the reports of the officers and committees were read and disposed of, and the following officers elected for the ensuing year:

President, O Butler, Savannah. Vice-Presidents—H. P. Tarrant, Augusta; J. M. Madden, Brunswick; J. W. Jaynes, Rome. Treasurer, John Ingalls, Macon. Secretary, Walter A. Taylor, Atlanta.

Resolutions of regret were passed relating to the death of Dr. J. A. Taylor, the first that has occurred since the organization of the society amongst its members.

The afternoon session was taken up by the address of Mr. J. A. Polhill and by discussions on a pharmacy law, a draft of which had been submitted at the morning session. At the evening session, nominations were made for the proposed State Pharmaceutical Board, a number of papers were read, and a committee appointed to perfect arrangements for the twenty-sixth annual meeting of the American Pharmaceutical Association to be held at Atlanta in September next. Mr. Isidore Zacharias was chosen as the next orator, and Savannah as the next place of meeting, and after various resolutions of thanks the meeting adjourned.

On the next day the members enjoyed an excursion up the great canal, and upon their return were made the recipients of an elegantly prepared dinner.

Cincinnati College of Pharmacy.—The commencement exercises were held at College Hall on Thursday evening, March 21st, when the President, Mr. George Eger, conferred degrees on the following gentlemen:

Henry Bertrams, Cincinnati; Alex. Colvard, Illinois; L. Dressel, Cincinnati; M. Gleick, Cincinnati; Frederick A. Grossman, Ohio; Henry Heister, Cincinnati; N. G. Hildreth, Ohio; Aug. J. Hofling, Cincinnati; Jno. H. Koenig, Kentucky; Jno. F. Kutchbauch, Ohio; Chas. A. Mohr, Alabama; Leo S. Schreck, Mexico.

Addresses were delivered by Prof. John A. Murphy, M.D, of the Miami Medical College, and by Prof. E. S. Wayne.

The prizes were then awarded as follows: for pharmacy, by Prof. Fennel, a prescription desk balance, to N. G. Hildreth; the Alumni medal for general proficiency, and Prof. Wayne's gold medal for proficiency in botany and materia medica, to Chas. A. Mohr; the chemistry prize, a complete set of blow-pipe apparatus, by Prof. Judge, to Leo S. Schreck.

A life-size portrait, in oil, of Prof. Wayne was presented to the College by Mr. Hofling, on behalf of the graduating class. Mr. F. A. Grossman then read the valedictory, which concluded the exercises.

The Alumni Association of the Cincinnati College of Pharmacy held their annual meeting on Wednesday, March 20th, 1878. After the new members from the graduating class had been received into the association, the following officers were elected for the ensuing year:

President, Louis Heister. Vice-Presidents—August Hofling, Herman Wilfert. Recording Secretary, Theodore Bange. Corresponding Secretary, Albert Wetterstroem. Treasurer, Robert M. Kuerze. Executive Board, for one year—G. A. Fieber, M. Gleick, Theo. Pellens, C. M. Greve; for two years—E. A. Schmidt, E. T. Harley. Delegates to Pharmaceutical Association—Jos. H. Feemster, C. P. Rendigs, Louis Schwab, R. M. Kuerze, C. M. Greve.

The association will hereafter meet on the first Tuesday of every third month, for the discussion of scientific subjects relating to pharmacy and its collateral branches. On Thursday evening, March 21st, after commencement exercises, the Alumni gave a reception at the Highland House in honor of the graduating class, in which dancing and other amusements were indulged in.

St. Louis College of Pharmacy.—The Twelfth Annual Commencement of the St. Louis College of Pharmacy, and the Third Annual Reception of the Alumni Association, took place on Monday evening, March 18, at Germania Club Hall. The President, Charles Bang, conferred the degree of Graduate in Pharmacy on the following gentlemen: John F. Barker, California; Chas. E. Smith, Indiana; David J. Holfbauer, Missouri; A. G. Behrens, G. E. Bœhlan, Chas. T. Gasewisch, David S. Green, Wm. P. Gulick, Peter Hoffmann, G. Kern, G. R. Mullhal, J. I. Murray, A. R. Mynders and Wm. S. Ondyn, all of St. Louis.

The Valedictory Address on the part of the Faculty was delivered by Professor Otto A. Wall and on the part of the class by Chas. E. Smith. At the Alumni Reception, President Francis Hemm delivered the address of welcome and awarded the Certificates of Membership. The Alumni Prize, a silver medal, was awarded to Mr. D. F. Gasewisch, the most proficient in all the branches taught. An address by Wm. C. Balm closed this part of the exercises and was followed by a grand hop, which concluded the entertainment.

Pharmaceutical Society of Great Britain.—At the Pharmaceutical Meeting of March 6, Mr. Harold Senier read a paper on *croton oil.* Referring to the observations of Pereira, Redwood and Warington (see "Am. Jour. Phar.," 1850, p. 218, and 1865, p. 191), the author confirms the statement that croton oil becomes more soluble in alcohol by age; absolute alcohol and spirit of sp. gr. ·838 dissolved 20 per cent. of freshly-expressed oil, 40 per cent. when three months old, 55 per cent. when three years, and 60 per cent. when over three years old. The portion insoluble in alcohol, when applied to the skin, produced no effect whatever, but the soluble portion, after the evaporation of the alcohol, was exceedingly active. The latter, at 32°F., has the consistence of butter, at 50° is too viscid to flow, at 60° has the sp. gr. ·987, is reddish-brown with a slight fluorescence, the characteristic odor and of turbid appearance from suspended acicular crystals, which are soluble on slightly warming the oil. Heated to 460°F. by itself, and to 360°F. with hydrochloric acid or strong potassa solution, the oil does not appear to lose any of its activity.

Prof. Redwood referred to his experiments, made about 30 years ago, when he found all English-pressed croton oils to be perfectly soluble in an equal bulk of absolute alcohol, the solution separating, however, when cooled to between 30° and 40°F. At that time Dr. Paul, while engaged in the process of grinding the seeds, suddenly became insensible, the effects upon him being narcotic in character, and not accompanied by purging and irritation.

Prof. Bentley alluded to the possibility that both a vesicating and a purgative principle would be found in croton oil; the former was called crotonol by Schlippe, but has not been obtained by any other chemist; the latter has never been isolated, and is in some degree connected with the purgative principle of castor oil, which is said to be an acrid resinous substance, but has likewise not been isolated.

Mr. Umney stated that at present all the croton oil of Great Britain was pressed by one firm only.

Mr. Gerrard said that the croton oil now in use at the University College Hospital had been there five years, and, from the fact that physicians continued to prescribe the minim dose, he thought it might be inferred that age did not increase the activity of the oil. Mr. Holmes, however, thought that if the increase of the soluble portion was due to the production of resinified oil, it would necessarily follow that the oil would be more purgative.

Mr. E. M. Holmes read a paper on *Duboisia Myoporoides*, R. Br., a shrub or small tree, which is a native of Eastern Australia, New Caledonia and New Guinea. Its leaves are alternate, shortly stalked, quite smooth and entire, lanceolate, 3 to 4 inches long and about an inch broad in the middle. It has very small pale lilac or white flowers, arranged in terminal panicled cymes, and produces a small succulent berry-like fruit. Its didynamous stamens make it related to the scrophulariaceæ, but on account of its regular coralla it is now placed in the solanaceæ. The extract of the leaves closely resembles atropia in its action; the active principle has not been isolated, but the aqueous extract has been used in Sydney and Brisbane, and found to be more prompt and energetic than atropia, and certainly very much more so than the strongest extract of belladonna.

At the pharmaceutical meeting held April 3, Mr. John Williams read a paper on *salicylic acid*. The author had prepared this acid from oil of wintergreen, and exhibited samples of it, the neutral portion of the oil and the methylic alcohol separated from the acid. In comparing this natural salicylic acid with that artificially made, considerable differences were observed; one drachm of the former was found to require three ounces of boiling water to effect complete solution, the latter two or even only one and a half ounces. On adding to these concentrated solutions one-fifth alcohol and allowing to cool, the natural acid will crystallize in separate, distinct crystals, while the artificial will form a network of fine needles, or the lower grades a woolly-looking mass. The artificial salicylic acid was dissolved in boiling water, and neutralized by carbonate of calcium; on cooling, salicylate of calcium is deposited, and after several recrystallizations, when decomposed by hydrochloric acid and recrystallized from weak alcohol, yields salicylic acid absolutely identical with the natural acid. The uncrystallizable mother-liquor from the calcium salicylate, on being decomposed by hydrochloric acid, yields silvery plates of an acid quite distinct from salicylic acid, and more soluble in hot and cold water than the latter, also more than paraoxybenzoic acid. Its solution with perchloride of iron does not give a yellow precipitate, characteristic of the last-named, but gives the so-called characteristic reaction of salicylic acid, probably due to not being entirely free from it. The quantity of this new acid, for which the name of *cresyl-salicylic acid* is for the present proposed, is estimated at from 15 to 25 per cent. of the artificial acid. The author will continue his investigations.

Mr. Plowman stated that the artificial salicylic acid given in doses of 20 grains every two or three hours had frequently caused delirium, but although it sometimes appeared to derange the system, at the same time it had the required effect of lowering the general temperature.

Mr. E. M. Holmes read a paper on *Grindelia robusta*. Referring to the observa-

tion of Prof. Maisch (February number, p. 87), and after examining the drug as imported into Great Britain, he concludes that it is not *G. robusta*, Nutt., but *G. squarrosa*, Dunal. The following characters are given for roughly distinguishing the species for pharmaceutical purposes: *G. squarrosa*—leaves narrowly lanceolate, tapering downwards to a small cordate base so that the upper portion of the leaf is broadest; scales of the involucre subulate and strongly curled backwards. *G. robusta*—leaves oblong, broadest at base, obtuse, and nearly twice the width of the preceding; scales of the involucre similar but less squarrose. *G. integrifolia*—leaves entire but very sparingly serrated, more tapering at apex and longer than the preceding. *G. inuloides*—leaves nearly as broad as those of robusta, oblong, wider at the base, and furnished with short closely set more obtuse teeth; the flower heads almost immersed in large leafy bracts. *G. glutinosa*—leaves lanceolate, tapering to the base, broader than the first; scales of the involucre linear, short-pointed and erect. *G. rubricaulis* (*G. hirsutula*)—stem purplish, involucre hairy, upper leaves larger at the base, lower leaves tapering towards the stem.

Mr. A. W. Gerrard read a paper on *the alkaloid and active principle of Duboisia myoporoides*. It was prepared by diffusing the aqueous extract in water, precipitating with alcohol, evaporating the filtrate, diluting with water, adding ammonia and agitating with chloroform. The alkaloid is a yellow viscous mass, freely soluble in alcohol, chloroform, ether, benzol and carbon bisulphide, fairly soluble in water and imparting to it a decided alkaline reaction. It was not obtained crystalline, and of its salts only the sulphate and hyrobromate crystallized in needles. It is very similar in its reactions to *atropia*, but differs from it in being more soluble in water, to require more acid for neutralizing, and to yield, when boiled with baryta, an unpleasant odor, while atropia by the same treatment gives off a pleasant odor reminding of gaultheria. With strong sulphuric acid in the cold, atropia remains unaffected, but on heating the mixture it darkens, evolving a pleasant aromatic odor, which the addition of potassium bichromate intensifies and at the same time yields a green precipitate of chromium oxide and vapors of an acid reaction. Duboisia alkaloid gives with sulphuric acid in the cold a reddish-brown color and when heated an odor unpleasant and suggestive of butyric acid; upon the addition of potassium bichromate, no reduction to the oxide was apparent, but the evolved vapor was of acid reaction. In its physiological action, the alkaloid was found to entirely agree with atropia.

Dr. Paul confirmed the statements as to the amorphous condition of most of the compounds. A note had been received from Mr. A. Petit, of Paris, giving similar results and stating that the aqueous solutions of the alkaloid were fluorescent and dichroic, being yellow by transmitted and blueish green by reflected light.

Dr. Bancroft, of Brisbane, who discovered the properties of duboisia, stated that the watery extract was equal, weight for weight, to atropia, and the physiological action of the two alkaloids would probably not be found identical.

Pharmaceutical Society of Paris.—At the meeting of February 6, a note by Mr. Carles was read, communicating the *analysis of citron juice*, which resulted as follows: free citric (and malic) acid 5·77, supercitrates of potassium ·96, of calcium

·88 and of iron ·11, glucose 2·45, gummy and albuminoid matters ·68, phosphates and other salts ·06 and water 89·09.

Mr. Stan. Martin presented a branch of *Satia tabernæmontana*, nat. ord. apocynaceæ, a shrub growing in rocky places, near the Senegal, where its root is used in elephantiasis.

Mr. Plauchud communicated the results of his observations in relation to the *decolorization of solution of litmus*; it is caused by the presence of organized and living germs, which, while developing, do not seem to act alike energetically.

Mr. Yvon reported on the application of glycerin in the preparation of certain oleo-stearates (like mercury), which are decomposed by contact with water.

At the March meeting a note by Mr. Ch. Tanret was read, in which he recommends, when testing for small quantities of *glucose in urine*, to precipitate the latter first with nitrate of mercury, and, without filtering, to add an excess of caustic soda before testing with Fehling's solution; if inosite be present a slight green precipitate takes place, but a decided precipitate of cuprous oxyde in the presence of but little glucose. Some albuminous matter in the urine interferes with the prompt action of Fehling's test liquid.

Mr. Yvon described the preparation of *iodide of ethyl* (*hydriodic ether*). He recommends the process of Personne and uses a tubulated retort, which is placed in a sand bath and has the neck connected with a receiver, which is plunged in cold water. 5 grams of phosphorus and 60 grams of alcohol are introduced into the retort, 20 grams of iodine are now added, and after a few minutes 20 grams more. Heat is carefully applied, care being taken that the whole of the liquid is uniformly heated, which is facilitated by the introduction of some pieces of platinum. With this precaution the liquid boils slowly, without concussions, and distils completely. The distillate may be colorless or colored by iodine; it is agitated with an aqueous solution of an alkaline carbonate, decanted, rectified and dried by a second distillation over calcium chloride. This last operation is indispensable for the preservation of the ether. To prevent the presence of free iodine, some silver foil is placed into the ether.

EDITORIAL DEPARTMENT.

THE present number of the "Journal" opens with an exhaustive article by Dr. Squibb on a subject of great importance to the pharmacist. Notwithstanding its length, it was deemed but just to the author, as well as to the readers, that it should appear undivided. Although this number has, like the preceding one, been increased from 48 to 64 pages, we have been compelled to reserve for the June number several original essays, letters and translations, and would embrace this occasion to thank our contributors and ask their indulgence at the delay of publication.

Naval Apothecaries.—The following letter explains itself:

To the Editor of the Journal of Pharmacy:—I desire to call the attention of pharmacists to a bill now before Congress, giving the rank of "Warrant Officers" to the apothecaries of the navy. Should

it become a law, the office of a naval apothecary will become very desirable, both in pay and position and the office should be filled by thoroughly competent men. The duties involve clerical as well as pharmaceautical work, and some knowledge of dentistry and minor surgery.

This would be a splendid field for "Graduates in Pharmacy," and no one who is not a graduate, or who cannot pass as *thorough a pharmaceutical examination*, should be admitted to the corps. Now is the time for the Colleges of Pharmacy, and the American Pharmaceutical Association to take action in this matter; memorialize the Secretary and Surgeon-General of the Navy in favor of the Graduate of Pharmacy, request a *rigid pharmaceutical* examination for apothecaries, etc, etc. The present incumbents, as a rule, are very badly educated, poor pharmacists, having only "shop knowledge," and many are intemperate and ignorant of pharmacy. Let *all* have a fair chance before an examining board, and there is little doubt the "graduates" would fill the 60 or 80 appointments that will have to be made under the law.

I trust, Mr. Editor, you will keep this subject before the pharmacists of the country until some decided action is taken thereon. As the appointments will be for life, with retiring pay and pensions in case of disability, it is all-important that no time be lost in looking after this matter. MEDICUS.

REVIEWS AND BIBLIOGRAPHICAL NOTICES.

Chemical Experimentation, being a hand-book of lecture experiments in Inorganic Chemistry, systematically arranged for the use of lecturers and teachers in chemistry, as well as for students in Normal Schools and Colleges and for private study. By Samuel P. Sadtler, A.M., Ph.D., Assistant Professor of Chemistry in the University of Pennsylvania. Louisville: John P. Morton & Co. 8vo, pp.225.

The work before us supplies a want which, we think, has been felt by most teachers of chemistry; it contains descriptions of a very large number of experiments, suited for the lecture room, and illustrating chemical reactions and the physical properties of the elements and their inorganic compounds. The descriptions are accurate and full, but free from prolixity, and can readily be followed by those having a general knowledge of chemical manipulations, even if not experienced in chemical experimentation; and this use is greatly facilitated by 139 excellent cuts, illustrating with exactness and precision the arrangement of the requisite apparatus. Moreover, the number of experiments described is so large that the teacher will find the book a useful aid for selecting such as may require either simple or more complicated apparatus. The author may therefore very properly express the hope that by its use "the teaching of chemistry might be sufficiently facilitated as to allow its introduction as a branch of study in many schools, where as yet it has been excluded or very greatly slighted." For the same reasons it will also be welcomed by those students who desire to repeat the experiments seen in the lecture room or to vary them with the aid of simpler apparatus.

The author has carefully abstained from the discussion of theoretical questions, the experiments being regarded as practical demonstration of facts; the work may therefore be used as a supplement to any good text-book on chemistry.

In recommending the book to teachers and to students in chemistry, we do so from the belief in its intrinsic worth, and when we state that its typographical execution is excellent, we regard this fact as a very acceptable addition to the other merits.

Fourteenth Annual Report of the Alumni Association, with the exercises of the fifty-seventh commencement of the Philadelphia College of Pharmacy. Philadelphia, 1878. 8vo, pp. 63.

The title-page of this pamphlet makes the erroneous statement that the commencement of March last was the *forty*-seventh of this College, while in point of fact lectures have been delivered annually without interruption since 1821, so that the course last closed was the *fifty*-seventh held in that institution. The introductory lecture at the opening and the valedictory delivered at the close of that course, the annual address to the alumni by Dr. A. W. Miller, an account of the transactions at the reception tendered to the last graduating class, minutes of the annual meeting and of the executive board, together with officers' reports and a list of the graduating class, comprise the contents of this pamphlet, which the alumni of the college may obtain by addressing Wallace Procter, 900 Lombard street, vice president of the association.

Proceedings of the Western Wholesale Drug Association, in convention at Louisville, Ky., Feb. 13 and 14, 1878. Cincinnati: Printed at the Aldine Printing Works. Pp. 45.

This association was organized at Indianapolis in 1876 (see "Am. Jour. Phar.," 1876, p. 233). Its objects, as expressed in the preamble to the constitution, are—"to create a permanent social feeling between the wholesale druggists of the West—to obliterate the feeling of distrust and jealousy that seems to exist—to correct excessive and unmercantile competition—to remove, by concert of action, all evils and customs that are against good policy and sound business principles—to establish rules and regulations that all differences and grievances may be fairly and equitably adjusted." The objects, it must be admitted, if faithfully carried out, would redound likewise to the benefit of the retail trade; and after carefully reading the proceedings we must say that the decided stand taken in the reports presented against inferior quality of goods, and in favor of honorable dealing, merits the support of the intelligent pharmacist, as it concerns likewise the wholesale trade. We need not leave the large cities to notice the ruinous competition in the sale of well-known articles, aiming, like the higgler on the street, at catching customers by excessively low prices for such articles, and charging extortionate rates for others the value of which cannot be judged by the purchaser. Credit in business, adulteration of drugs, some of the follies of the Wood tariff bill now before Congress, received due attention, and the convention finally adjourned to meet at Chicago next year on the second Wednesday of November.

The officers for the present year are: President, A. Peter, Louisville; Vice Presidents, C. F. G. Meyer, St. Louis; Jas. S. Burdsal, Cincinnati; Geo. A. Kelly, Pittsburg; D. R. Noyes, St. Paul, and Wm. Letterer, Nashville; Treasurer, S. M. Strong, Cleveland; Secretary, J. W. Plummer, Chicago. There was also appointed a board of control, and committees on price lists and circulars, on credits, on commercial travelers, on legislation, drug market, membership, fire insurance, proprietary goods and on adulteration of drugs.

The Multum in Parvo Reference and Dose Book. By C. H Leonard, M.A., M.D. Third edition. Detroit, 1878. 16mo, pp. 100. Price, bound, 75 cts.

The little book may be conveniently carried in the vest pocket and contains a good deal of information of value to the physician. We were rather surprised to find it contain a list of nearly a hundred elixirs and ever so many pills, evidently copied from the price lists of manufacturers. Such space, in our opinion, might have been occupied with more useful and more important information.

Sur la Composition des Cloportes. Par Dr. C. Méhu. Paris, 1878.
On the composition of hoglice (woodlice).

Two species, *Oniscus asellus* and *O. armadilla*, Lin., are still recognized in the French Pharmacopœia, and to some extent employed by the people mainly on account of their diuretic properties. The second species is found in commerce; after drying completely it was found to contain 44·46 per cent. of organic compounds, and of the remaining inorganic constituents 2·26 per cent. were soluble and 33·28 insoluble in water. The first species, dried, left 34·1 per cent. mineral residue on incineration. The author very properly argues in favor of dismissing these little crustaceæ from the Pharmacopœia.

Chemische Beiträge zur Pomologie, mit Berücksichtigung der livlandischen Obstcultur. Von Dr. G. Dragendorff. Dorpat, 1878. 8vo, pp. 102.
Chemical contributions to pomology, with reference to the fruit culture of Livland.

This is a very creditable work, undertaken with the view of promoting the culture of apples in the western part of Russia.

Botanischer Congress (Abtheilung Chinarinden) und Ausstellung pharmaceutisch wichtiger Pflanzenproducte zu Amsterdam, im April, 1877. Von Prof. Ed. Schaer in Zürich. Pp. 21.
Botanical Congress (section cinchonabarks) and exhibition of pharmaceutically important vegetable products at Amsterdam, April, 1877.

We regret that we cannot make room for a translation of this interesting essay. A portion of the exhibit of cinchonas, we judge, was the same that had been at the Centennial Exposition and of which we have given an account before ("Am. Jour. Phar.," 1876, p. 323).

Die Deutsch-Amerikanische Gewerbe- und Industrie-Zeitung: Fortschritt der Zeit.
The German-American Industrial Gazette: Progress of the Age. R. A. Koss, editor. W. W. Coleman, publisher. New York and Milwaukee. Monthly. Price, 75 cents per year.

About a year ago the two German periodicals, the Gazette and Progress of the Age, were consolidated, and since that time have appeared under the united title given above. We believe that this is the only paper covering the field of industrial sciences, inventions and discoveries, which is published in the United States in the German language; and we notice that preparations are being made to issue it semi-monthly after a few months.

We acknowledge the receipt of the following investigations from the laboratory of the Pharmaceutical Institute at Dorpat:

Werthbestimmung des Wismuths und des käuflichen Magisterium Bismuthi. Von Jul. Lōwy.
Valuation of bismuth and its commercial subnitrate.

Beiträge zur Ermittelung einiger Hopfensurrogate im Biere. Von Wilh. Meyke.
On the recognition of some substitutes for hops in beer.

Rhabarber Analysen. Von Dragendorff.
Analysis of rhubarb.

Ein Beitrag zur Kenntniss der Mutterkorn-Alkaloide. Von Theod. Blumberg.
On the alkaloids of ergot.

We likewise acknowledge the receipt of the following pamphlets:

Descriptive and Statistical History of Tobacco. By E. H. Gilmore. Washington, D. C., 1878. Price, 25 cts.

Annual Review of the Drug Trade of New York for the year 1877. Prepared by D. C. Robbins. New York, 1878.

Bathing, Cupping, Electricity, Massage, etc. By David Prince, M.D. Reprint from the "American Practitioner," Feb., 1878.

Proceedings of the Louisiana State Medical Association, etc. New Orleans, 1878.
This State Association was organized at New Orleans in January last.

Medicinal Plants indigenous in Michigan. By A. B. Lyons, M.D. Pp. 25.
The paper was read before the Detroit Academy of Medicine.

OBITUARY.

DANIEL HENCHMAN, probably the oldest apothecary in the United States, died in his native city, Boston, April 13, at the advanced age of 88 years. Born in 1790, he purchased the lot where he carried on business in 1814, and erected a store and dwelling house, which is still standing. The lower floor was originally divided into two stores, one of which was occupied by Mr. Henchman, and enlarged by the addition of the other store when this was vacated by its first tenant. In this place the deceased carried on the drug and apothecary business for 63 years, and the store even to this day presents an ancient appearance. In it may be seen long rows of old-fashioned plain-blown glass jars, capped with tin covers, painted green and ornamented with quaint and elaborate labels, consisting of grotesque figures, scroll-work and letters in gilt and yellow. Several shelves are filled with earthen jars of various shapes, and decorated after the style known to pottery dealers as "flowing blue." The only modern embellishment was a small Tuft's soda fountain.

The deceased was one of the early presidents of the Massachusetts College of Pharmacy, and during his life-time held many offices of honor and trust, the duties of which he discharged with that faithfulness and strict integrity which marked all his acts, public and private. We well remember the meeting of the American Pharmaceutical Association of 1865, when we met the deceased for the first time, and the peculiar fascination of listening to his vivid descriptions of customs and occurrences of half a century ago. Requiescat!